The FOUNDRY

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All Ready for Columbus Convention

Excellence of Program and Unprecedented Scope of the Exhibition of Foundry Supplies and Equipment Promise Great Opportunity To Visiting Foundrymen—All Activities at State Fair Grounds

DURING the week of Oct. 4, Ohio will welcome the members of the American Foundrymen's association for the fifth time. On four previous occasions, twice at Cleveland and twice at Cincinnati has the state been host to this society which represents the foundry industry of the country. The choice of the capital city at this time was particularly fortunate. Situated as it is in the geographical center Columbus serves truly to represent the foundries of the entire state. Ohio at the completion of the most recent count still maintains a high standing with the total number of foundries within its borders. In 1918 there were 6444 foundries in the United States and Canada and of these 656 or more than 10 per cent were within the borders of that state, which ranked second only to Pennsylvania with a total of 806 active castings establishments.

A recently completed survey made by THE FOUNDRY indicates that there are a total of 689 foundries in Ohio, which again is second to Pennsylvania with its total of 888 shops. The importance of the state in this regard assures a record attendance at the convention from the foundries within the borders. Further, the location chosen is ideal to draw from the eastern and Mississippi valley regions wherein are situated most of the large foundry centers of the country.

Last year, when the convention was held in Philadelphia, many felt that a record attendance had been established which would not again be excelled. This may be true, but the interest evidenced throughout this country and abroad indicates that the Columbus gathering may equal if not surpass that held in the Quaker City, last vear.

The state fair grounds at Columbus will serve to accommodate all of the activities of the convention. A group of seven buildings has been set aside, and work was started immediately upon the close of the state fair, Sept. 4, to prepare for the foundrymen. The registration offices and lecture rooms for the technical sessions will be established in the first of the group of buildings. A covered walk, leading from the street car shed at the entrance to the grounds, terminates at the entrance to this building. From the opposite end, similarly covered walks serve to connect the second, third and fourth, while beside these are the fifth, sixth and seventh buildings, respectively. This close grouping of all activities will serve to save a great deal of time to visitors, which last year was expended in going

from the meetings in down-town hotels to the exhibition at the Philadelphia Commercial Museums.

The great number of foreign visitors who last year visited the convention, it is thought, will be exceeded by this year's attendance from overseas. At a recent meeting of the Institution of British Foundrymen, held in Glasgow, keen interest was expressed in the approaching Columbus convention. At that time a desire was expressed to arrange an interchange of technical papers presented before the two societies in an effort to broaden the practical knowledge of the industry.

With more than 70 papers and committee reports on the tentative program, the technical sessions of the twenty-fifth annual meeting of the American Foundrymen's association, Inc., promises to surpass those of previous years in interest and value. In order that foundrymen can have an opportunity to hear more papers than was possible under the plan of holding three sessions at the same time, the program for the Columbus meeting has been arranged so that only two meetings are held simultaneously. Steel and nonferrous sessions will be held at the same hours Wednesday afternoon and Thursday morning, but all other meetings, with the possible exception of that scheduled for Friday morning, will be held separately. Under this plan, the necessity of dividing attention between two or three meetings is avoided.

Business Session Shifted

Another important change has been made by which it is hoped more time can be given to the annual business meeting. In past years attempts have been made to sandwich the transaction of business in between papers in technical sessions with the result that the meetings were prolonged to the point where the patience of members was sorely tried. This year the business session will be held Thursday evening at 8 o'clock, in connection with a "get-together" smoker. The annual address of the president and the reports of the board of directors and secretary-treasurer will be presented at this meeting. The annual banquet will be held Wednesday evening.

On account of the unusual interest evidenced in the subject of industrial relations at the Philadelphia convention last year, two sessions devoted to the subject have been arranged for this year. Many phases of the broad topic of industrial relationship will be discussed, including Americanism, training foundry executives, employment, vocational training, and relations between employers and their employes.

Another change introduced since last year's meeting involves the holding of joint sessions on the subject of nonferrous foundry practice with the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers. These joint meetings will be held Tuesday afternoon and Wednesday morning and will be marked by papers presented by the members of both organizations.

Condensed Program

Monday, Oct. 4

10:00 A. M.—Registration, Building No. 1, Ohio State Fair Grounds, Columbus, O.
10:00 A. M.—Opening of exhibition, Ohio State Fair Grounds.

Tuesday, Oct. 5

9:00 A. M.—Exhibit opens and remains open until 10:00 p. m.
9:30 A. M.—Gray iron and general session, lecture hall of Building No. 1, Ohio State Fair grounds.
2:00 P. M.—Steel session, Building No. 1.
2:00 P. M.—Nonferrous section session held jointly by the American Foundrymen's association and the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers, Building No. 1.
8:00 P. M.—Exhibit remains open until 10:00 p. m.

Wednesday, Oct. 6

9:00 A. M.—Exhibit open until 5:00 p. m.
9:30 A. M.—Steel session, American Foundrymen's association, Building No. 1.
9:30 A. M.—Nonferrous section session held jointly by the American Foundrymen's association and the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers, Building No. 1.
2:00 P. M.—Industrial relations session, American Foundrymen's association, Building No. 1.
7:00 P. M.—Annual banquet.

Thursday, Oct. 7

7:00 P.M.—Annual banquet.
9:30 A. M.—Industrial relations session, American Foundrymen's association, Building No. 1.
1:00 P. M.—Special entertainment.
8:00 P. M.—Smoker at the Hotel Deshler, including business session, address by the president and reports of the officers.

Friday, Oct. 8

9:00 A. M.—Exhibit open until 5:00 p. m.
9:30 A. M.—Malleable session, American Foundrymen's association, Building No. 1.
9:30 A. M.—General session, American Foundrymen's association.

The metallurgical questions encountered in gray-iron foundry practice will be thoroughly discussed at the initial technical meeting, which will be held Tuesday morning, Oct. 5, at 10:30 a. m. Questions of sampling for analytical determinations, and of specifications covering gray iron will be given attention at this session. Two exceedingly interesting papers on the details of producing machine tool castings have been prepared by Leroy Sherwin, Brown & Sharp Mfg. Co., Providence, R. I., and A. N. Kelley, Cincinnati.

In the steel session to be held Wednesday morning, a great deal of attention will be given to the heat treatment of steel castings. Those who contributed papers on this subject include, E. F. Collins, General Electric Co., Schenectady, N. Y.; F. E. Brown, bureau of standards, Washington; Fred Grotts, Holt Mfg. Co., Peoria, Ill.; T. F. Baily, Electric Furnace Co., Alliance, O.; and C. H. Gale, Pressed Steel Car Co., McKees Rocks, Pa.

Live Malleable Session

The technical session on Friday morning, devoted to the subject of malleable iron, should prove of the greatest interest to all foundrymen, even though they are not directly interested in this phase of the industry. At this time the triplex process of making malleable iron will be presented in a paper by H. A. Schwartz, National Malleable Castings Co., Indianapolis. This will be the first complete and detailed description of this process which has been offered since the company first inaugurated this practice some three years ago. Other valuable papers on the subject of making malleable iron, fuel and fuel consumption and lining materials for furnaces and ovens will be given at this same meeting.

A great variety of interesting subjects will be covered in the final technical session which will be held Friday morning. At this time papers on welding will be given by A. S. Kinsey, Stevens Institute of Technology, Hoboken, N. J., and A. M. Candy, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Another important discussion at this session will deal with the question of testing molding sand. As is known to most foundrymen, there has been but little offered on this subject in the literature of the industry, and the paper by S. W. Stratton, bureau of standards, Washington, should do much to point the way in this important study. Other papers to be given at this time deal with the planning of equipment for foundries and the care of such equipment after it is in service. Some valuable points on foundry design and construction are contained in papers by James Brakes, Jr., Chicago, Frank D. Chase, Chicago, and Lieut. Col. H. C. Boyden, Portland Cement association, Chicago. Lieut. R. F. Nourse of the United

Program of Technical Sessions at Columbus

American Foundrymen's Association Group Meetings and Joint Sessions with the Institute of Metals Division, A. I. M. M. E.

Monday, Oct. 4

10:00 A. M.—Registration—Building No. 1, Ohio State Fair grounds.
10:00 A. M.—Opening of exhibition.

Tuesday, Oct. 5

10:30 A. M.—Technical Session—Gray Iron and General.
ZIRCONIUM IN CAST IRON, by Richard Moldenke, Watchung, N. J.
STANDARDIZING GRAY IRON SAMPLES FOR ANALYTICAL DETERMINATION, by Edward J. Fowler, Pacific Foundry Co., San Francisco.
A NOTE ON THE ELECTRIC FURNACE AND THE PROBLEM OF SULPHUR IN CAST IRON, by George K. Elliott, Lunkenheimer Co., Cincinnati.
PRODUCTION OF MILLING MACHINE TABLE CASTINGS, by Leroy Sherwin, Brown & Sharp Mfg. Co., Providencee, R. I.
FOUNDRY METHODS AND EQUIPMENT FOR PRODUCING MACHINE TOOL CASTINGS, by A. N. Kelley, Cincinnati.
ELECTRICAL APPARATUS IN A MODERN IRON FOUNDRY, by F. D. Egan, Westinghouse Electric Mfg. Co., East Pittsburgh, Pa.
REPORT OF COMMITTEE ON GENERAL SPECIFICATIONS FOR GRAY IRON CASTINGS TO CO-OPERATE WITH A. S. T. M., by Richard Moldenke, Chairman, Watchung, N. J.
THE CONTROL OF METALLURGICAL OPERATIONS IN THE FOUNDRY, by H. L. Campbell, Industrial Works, Bay City, Mich.

Tuesday, Oct. 5

2:00 P. M.—Technical Session—Nonferrous Practice (Held jointly by Institute of Metals Division of A. I. M. M. E. and the American Foundrymen's association).
INVESTIGATION OF BRASS FOUNDRY FLUXES, by C. W. Hill, T. P. Thomas and W. B. Viez.
LABORATORY TESTING OF SANDS, CORES AND COREBINDERS, by F. L. Wolf and A. A. Grubb.
THE RECLAMATION OF METAL FROM BRASS FOUNDRY REFUSE, by F. L. Wolf and J. E. Alderson.
A NEW PROCESS FOR MAKING 15 PER CENT PHOSPHOR COPPER, by P. E. Demmler.
RECENT DEVELOPMENTS IN DIE CASTING, by Charles Pack, Doehler Die Casting Co., Brooklyn, N. Y.
THE SOLUBILITY OF HYDROGEN IN MOLTEN COPPER AND COPPER ALLOYS, by C. W. Hill, T. P. Thomas and G. P. Luckey.

Tuesday, Oct. 5

2:00 P. M.—Technical Session—Steel.
OBTAINING MOLDING MATERIALS FOR THE STEEL FOUNDRY, by R. L. Lindstrom, Canadian Steel Foundries, Ltd., Montreal.
DESIRABILITY OF WORKING WITH PROSPECTIVE CUSTOMERS IN THE DESIGN OF CASTINGS, by K. W. Wheeler, Lebanon Steel Foundry, Lebanon, Pa.
METHODS OF HEADING AND GATING STEEL CASTINGS, by R. J. Doty, Slyver Steel Casting Co., Milwaukee.
GATING, POURING AND FEEDING STEEL CASTINGS, by R. B. Farquhar, Electric Steel Co. of Indiana, Indianapolis.
REPORT OF COMMITTEE ON STEEL FOUNDRY STANDARDS, by W. A. Janssen, chairman, American Steel Foundries, Chicago.
REPORT OF COMMITTEE ON SPECIFICATIONS FOR STEEL CASTINGS TO CO-OPERATE WITH A. S. T. M., by R. A. Bull, chairman, Duquesne Steel Foundry Co., Coraopolis, Pa.
A NOVEL CORE OVEN, by Stephen B. Phelps, Jones & Laughlin Steel Co., Pittsburgh.

Wednesday, Oct. 6

9:30 A. M.—Technical Session—Nonferrous Practice (Held jointly by Institute of Metals Division of A. I. M. M. E. and the American Foundrymen's association).
CASTING LOSSES IN THE ALUMINUM FOUNDRY, by Robert J. Anderson, Bureau of Mines, Pittsburgh.
COKE AND BY-PRODUCTS AS FUELS FOR METALS MELTING, by F. W. Sperr Jr.
A NEW ELECTRIC FURNACE FOR MELTING BRASS, by C. H. Booth, Booth Electric Furnace Co., Chicago.
STATUS OF THE ELECTRIC FURNACE IN NONFERROUS INDUSTRY, by E. F. Cone, *The Iron Age*, New York.
PROBLEMS OF THE NONFERROUS FOUNDRY, by Russell R. Clarke.

Wednesday, Oct. 6

9:30 A. M.—Technical Session—Steel.
ANNEALING STEEL WITH PULVERIZED COAL, by C. H. Gale, Pressed Steel Car Co., McKees Rocks, Pa.
ACCURATE TREATMENT OF STEEL CASTINGS, by T. F. Baily, the Electric Furnace Co., Alliance, O.
HEAT TREATMENT OF STEEL, by F. E. Brown, U. S. Bureau of Standards, Washington.
ELECTRIC HEAT TREATING OF STEEL CASTINGS, by E. F. Collins, General Electric Co., Schenectady, N. Y.
HEAT TREATMENT OF STEEL TRACTOR CASTINGS, by Fred Grotts, Holt Mfg. Co., Peoria, Ill.
ELECTRIC STEEL MAKING, by James W. Galvin, Ohio Steel Foundry Co., Springfield, O.

Wednesday, Oct. 6

2:00 P. M.—Industrial Relations.
INDUSTRIAL RELATIONSHIPS BETWEEN EMPLOYER AND EMPLOYE, by Myer Bloomfield, Industrial Relations, Boston, Mass.
TRAINING FOUNDRY EXECUTIVES, by R. E. Kennedy and Bruce W. Benedict, Shop Laboratories, University of Illinois, Urbana, Ill.
THE FOREMAN'S RELATIONSHIP TO THE WORKER, by Charles Prosser, director, Dunwoodye institute, Minneapolis.
DEVELOPING THE FOREMAN, by M. C. Evans, secretary, Foreman's Development Course Committee, International Harvester Co., Chicago.
AMERICANIZATION, by Fred H. Rindge, executive secretary, Y. M. C. A., New York.
REPORT OF COMMITTEE ON SAFETY, SANITATION AND FIRE PREVENTION, by Benjamin D. Fuller, chairman, Niagara Falls, N. Y.

Thursday, Oct. 7

9:30 A. M.—Industrial Relations.
THE RIGHT MAN ON THE RIGHT JOB, by Arthur H. Young, manager, industrial relations, International Harvester Co., Chicago.
MODERN EMPLOYMENT AND PERSONNEL METHODS, by Dudley R. Kennedy, Cluett, Peabody & Co., Troy, N. Y.
EMPLOYMENT PROBLEMS, by Ralph M. Wells, Employment Managers' association, 6 Beacon street, Boston.
INDUSTRIAL RELATIONS WORK AS APPLIED TO FOUNDRIES, by James W. Brown, manager industrial relations department, Chain Belt Co., Milwaukee.
VARIOUS PLANS OF INDUSTRIAL RELATIONS, by Ray Vance, service director, Brookmire Economic Service, Inc., New York.
EDUCATION AND VOCATIONAL TRAINING FOR EMPLOYES, by A. C. Horrocks, educational director, Goodyear Tire & Rubber Co., Akron, O.
REPORT OF COMMITTEE ON INDUSTRIAL EDUCATION AND TRAINING OF APPRENTICES, by C. B. Connelley, chairman, department of labor and industry, Harrisburg, Pa.

Thursday, Oct. 7

9:30 A. M.—General and Metallographic Session of the Institute of Metals Division of A. I. M. M. E.
CHARPY IMPACT TEST AS APPLIED TO ALUMINUM ALLOYS, by E. H. Dix.
COLLOIDAL STATE IN METALS AND ALLOYS, by Jerome Alexander.
TRANSITION PHENOMENA IN AMALGAMS, by A. W. Gray.
PHYSICAL TESTS ON SHEET NICKEL-SILVER, by W. B. Price and P. Davidson.
NICKEL-CHROMIUM ALLOYS, by Leon O. Hart.
COPPER CRUSHER CYLINDERS, by A. I. Krynitzky.

Thursday, Oct. 7

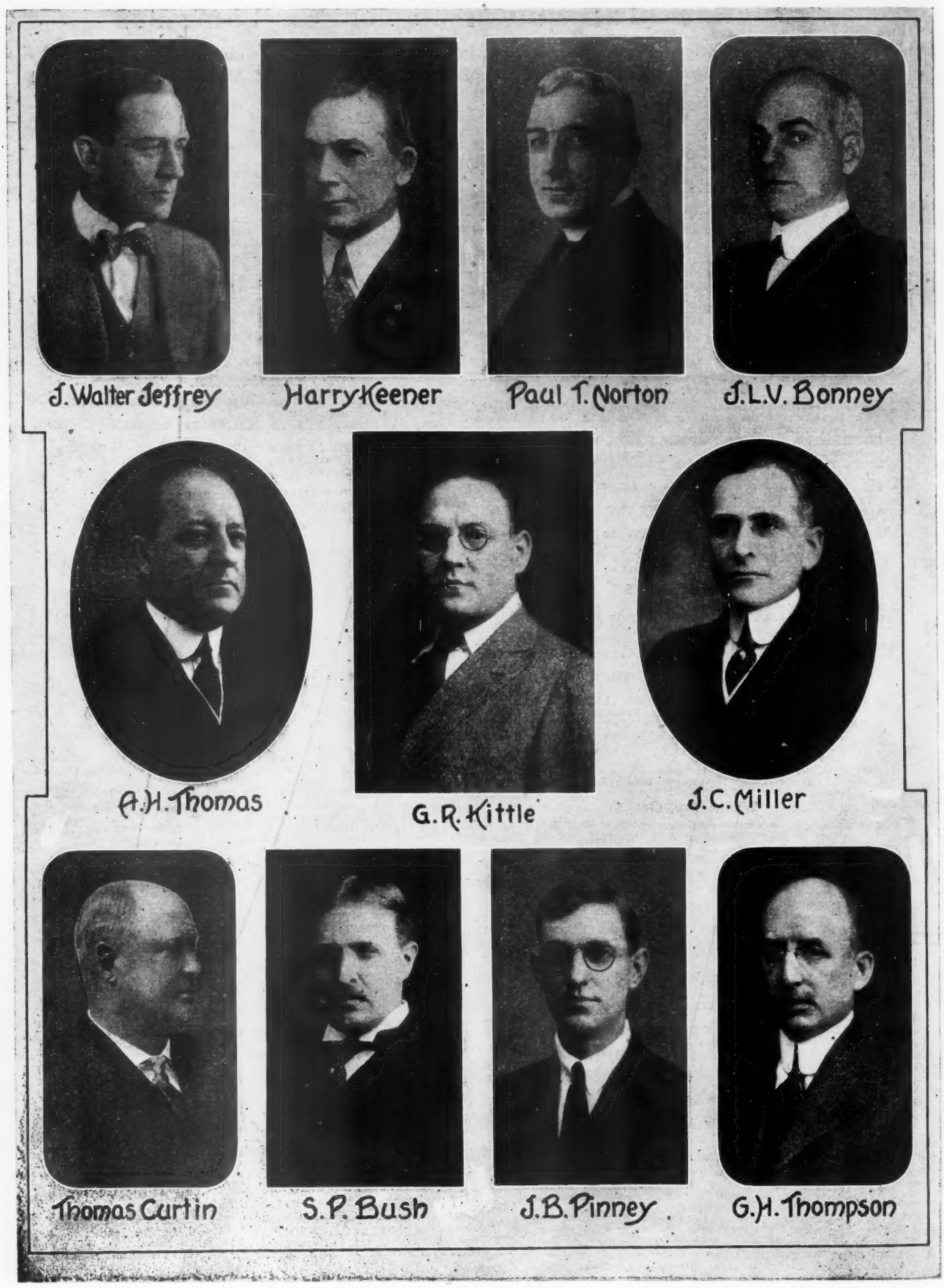
8:00 P. M.—Business Meeting.
ANNUAL ADDRESS OF THE PRESIDENT, by C. S. Koch, Fort Pitt Steel Foundry Co., McKeesport, Pa.
REPORT OF BOARD OF DIRECTORS, by C. E. Hoyt, secretary.
REPORT OF SECRETARY-TREASURER, by C. E. Hoyt, secretary.
AMERICANIZATION, by Dr. R. M. Little, director, American Institute of Safety, New York.
9:00 P. M.—Smoker.

Friday, Oct. 8

9:30 A. M.—Technical Session—Malleable Iron.
THE TRIPLEX PROCESS OF MAKING MALLEABLE IRON, by H. A. Schwartz, National Malleable Castings Co., Indianapolis.
NOTES ON MALLEABLE IRON, by Enrique Touceda, Albany, N. Y.
FRACTURES AND MICROSTRUCTURES OF AMERICAN MALLEABLE CAST IRON, by W. R. Bean, H. W. Highriter and E. S. Davenport, Eastern Malleable Iron Co., Naugatuck, Conn.
A NEW RESEARCH DEPARTMENT FOR A LARGE MALLEABLE PLANT, by H. A. Schwartz, National Malleable Castings Co., Indianapolis.
FUEL AND COMBUSTION, by Max Slosky, Deere & Co., Moline, Ill.
REFRACTORY BRICK AND MATERIALS, by Dr. M. L. Hartman, Carborundum Co., Niagara Falls, N. Y.
REPORT OF COMMITTEE ON SPECIFICATIONS FOR MALLEABLE IRON CASTINGS, by Enrique Touceda, chairman, Albany, N. Y.

Friday, Oct. 8

9:30 A. M.—General Session.
THE CARE OF FOUNDRY EQUIPMENT, by David McLain, McLain's System, Milwaukee.
IMPORTANT CONSIDERATIONS IN THE DESIGN OF MODERN FOUNDRIES, by J. H. Hopp, Charles C. Kawin Co., Chicago.
CLEANING ROOM METHODS, by A. W. Gregg, Whiting Foundry Equipment Co., Chicago.
ARC WELDING MACHINES FOR THE FOUNDRY, by A. M. Candy, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
THE FUSION WELDING OF IRON CASTINGS, by A. S. Kinsey, Stevens Institute of Technology, Hoboken, N. J.
PROPER ILLUMINATION AS AN AID TO FOUNDRY PRODUCTION, by James Brakes Jr., Chicago.
THE EQUIPMENT OF THE FOUNDRY—TODAY AND IN THE NEAR FUTURE, by A. R. Atwater, Osborn Mfg. Co., Cleveland.
APPROVED METHODS OF TESTING MOLDING SAND, by S. W. Stratton, Bureau of Standards, Washington.
REPORT OF COMMITTEE ADVISORY TO THE U. S. BUREAU OF STANDARDS, by Richard Moldenke, Watchung, N. J.
COST ACCOUNTING, by F. C. Everett, Miller, Franklin, Bassett & Co., New York.
REPORT OF COMMITTEE ON FOUNDRY COSTS, by J. Roy Tanner, Pittsburgh Valve, Foundry & Construction Co., Pittsburgh.
BRITISH AND CONTINENTAL MOLDING MACHINES, by H. Cole Estep, Penton Publishing Co., London, Eng.
FOUNDRY ENGINEERING, by Frank D. Chase, Frank D. Chase, Inc., Chicago.
THE ONE BEST WAY TO DO WORK, by F. B. Gilbreth, Montclair, N. J.
THE FOUNDRY OF THE U. S. S. PROMETHEUS, REPAIR SHIP OF THE ATLANTIC FLEET, by Lieut. R. F. Nourse, United States navy.
REPORT OF COMMITTEE ON SPECIFICATIONS FOR FOUNDRY SCRAP, by J. G. Garrard, chairman, Northwestern Malleable Iron Co., Milwaukee.
CONCRETE MOLDING FLOORS, by Lieut.-Col. H. C. Boyden, Portland Cement Association, Chicago.



COLUMBUS BUSINESS MEN AND MANUFACTURERS HAVE TAKEN AN ACTIVE PART IN PREPARING FOR THE CONVENTION AND THE RECEPTION OF THE VISITING FOUNDRYMEN—A PROGRAM OF ENTERTAINMENT FOR THE LADIES AND A SERIES OF VISITS TO LOCAL PLANTS HAS BEEN ARRANGED

States navy will describe an unusual foundry which is in operation on a repair ship of the Atlantic fleet.

A program of entertainment to include an entire afternoon for diversion on Thursday to be followed by a smoker in the evening is being provided by a Columbus committee working together with a committee appointed by President Koch of the association.

That the annual convention of the American Foundrymen's association offers the best possible opportunity to present to prospective buyers the merit of their products, is evidenced by the growing interest from year to year in the exhibition on the part of both material and equipment firms which supply foundry needs. This year the seven buildings at the fair grounds offer the best possible conditions for display and demonstration purposes. This natural division of the show permits exhibits to be grouped according to their similar nature, and gives the visitor an opportunity to spend a greater amount of time with those in which he is most vitally interested. At the same time, the arrangement is such that it is possible to proceed from one building to the next almost without being conscious that the displays are housed in separate structures. A greater number of firms have contracted for space this year than at any time in the past, and the rapid strides evident in many lines since the war may be noted at this time.

Unlike many of the cities which have entertained annual sessions of the American Foundrymen's association in the past, Columbus is not preeminently a foundry center. Judged on the basis of the number of shops or the tonnage of products, this city is not to be compared with some of those whose natural advantages have entitled them to be ranked as leaders in the industry which supports and derives marked advantages from the Foundrymen's association. However, viewing the shops as units, and comparing them upon a similar basis with those in other cities, the foundries of Columbus will be found to be progressive, well managed and exceptionally efficient.

Columbus dates back to 1797 when a Kentucky surveyor laid off the village of Franklinton, now west Columbus. The capital city, as such did not come into being until 1812, when the legislature in session at Zanesville, settled upon this site on the banks of the Scioto river as the logical geographical location for the state government. Flour mills, following the logical course of human necessity gave the first indication of active industrial life, and then as settlers commenced to find their way into this fertile region, the need for implements of iron to reduce the wilderness and to develop the great agricultural promise of the country brought about the establishment of the first foundry and plow works. This was a plant built by Joseph Ridgeway and put into operation in 1822. Ridgeway's foundry probably marks one of the earliest steps in the establishment of the great foundry industry of Ohio, which extends throughout the state and finds its greatest development in the vicinity of Cleveland and of Cincinnati.

Another pioneer foundryman of Columbus was John L. Gill who in 1826 built one of the first car and car wheel plants in the country. Mr. Gill was prominently identified with the early development of the city. He brought the first coal from some of the newly opened regions in southern Ohio. When a branch was constructed, connecting the capital with the canal which extended the length of the state, the first boats over the lateral canal from Circleville carried consignments to the Gill foundries. John L. Gill was the first to make coke in that section of the state, and the first to engage in a commission business in iron. This was at a time when Columbus was a city of only about 2000 to 3000 population. The Gill plant, like the Ridgeway foundry was sold, and both since have become extinct.

Among the three oldest firms in Columbus which still are engaged in business are the Kilbourne-Jacobs Co., the Kinnear Mfg. Co. and the Jeffrey Mfg. Co. The former was established by Col. James Kilbourne soon after the Civil war and the second was started as W. R. Kinnear & Co., manufacturers of iron cornices, in 1878.

The third establishment, and the one which is perhaps the largest industrial plant in Columbus at the present time is the Jeffrey Mfg. Co.

The Jeffrey Mfg. Co., established in 1876, had its beginning in a small one-room workshop, where Joseph A. Jeffrey, who is now and has been the head of this organization since it was founded, started to build a novel apparatus for cutting coal. Two years later saw a company incorporated with Mr. Jeffrey at its head. The business grew steadily and in 1888 it established itself in its present location.

It was natural that the company should not long confine itself to one piece of mining machinery, and it soon became an engineering center for mechanical problems relative to coal mining and the handling of all kinds of materials. The Jeffrey plant today covers over 30 acres of floor space, and is said to be the largest concern of its kind in the world. Over 3000 people are employed.

In the manufacture of the company's products no efforts and expense are spared to secure the highest standard of excellence. The highest grade of skilled mechanics are employed and the plant is thoroughly equipped with the most modern labor-saving devices for economical production and distribution. In addition to the manufacture of coal cutters, drills, pit car loaders, mine locomotives, tipple machinery equipment, including car hauls, screens, picking tables, loading booms and ventilating fans, the output of the Jeffrey Mfg. Co. now includes elevating and conveying equipment for the handling of materials in practically every industry. Chains of all

Columbus Local Committees

General Chairman

G. R. KITTLE,
The Ohio Malleable Iron Co.

Finance Committee

A. H. THOMAS, Chairman,
The Buckeye Steel Castings Co.
J. C. MILLER, Vice Chairman,
The American Rolling Mill Co.

Information Committee

THOMAS CURTIN, Chairman,
The Ralston Steel Car Co.
HARRY KEENER, Vice Chairman,
The Keener Sand & Clay Co.

Entertainment Committee

J. L. V. BONNEY, Chairman,
The Bonney-Floyd Co.
S. P. BUSH, Vice Chairman,
The Buckeye Steel Castings Co.
J. WALTER JEFFREY,
The Jeffrey Mfg. Co.
SAMUEL SUMMER,
The Jos. Schonthal Iron Co.
J. S. BALL,
The Central Foundry Equipment Co.

Plant Visitation Committee

G. H. THOMPSON, Chairman,
The Columbus Malleable Iron Co.
J. B. PINNEY, Vice Chairman,
The Jos. Schonthal Iron Co.
WALTER F. SHELDON,
The Jos. Schonthal Iron Co.

Automobile Committee

HARRY KEENER, Chairman,
The Keener Sand & Clay Co.
NELSON ROSE, Vice Chairman,
The Jones Sand Co.

Golf Committee

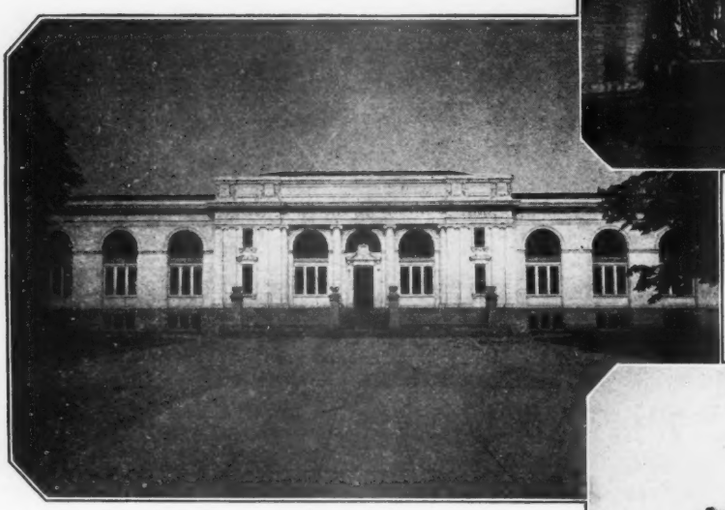
PAUL T. NORTON, Chairman,
The Case Crane & Engineering Co.
J. WALTER JEFFREY, Vice Chairman,
The Jeffrey Mfg. Co.
WALTER B. FLOYD,
The Bonney-Floyd Co.

Features of Civic Beauty and Industria

The visitor arrives at the Union Station on High street, only a short distance from the hotel and business center of the city

Corner of Broad and High streets

A beautiful memorial to William McKinley stands at the main entrance to the State House. Bronze figures at the right and left typify the arts and industries of the state



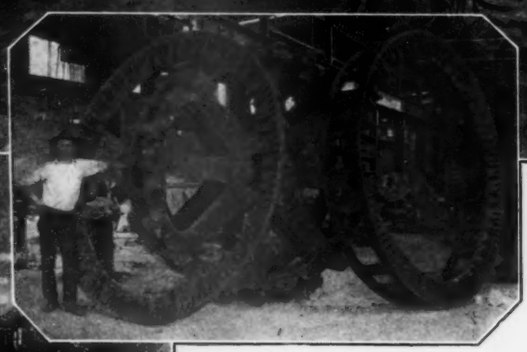
An exceptionally beautiful public library has been provided for the citizens of Columbus. This is maintained by the city

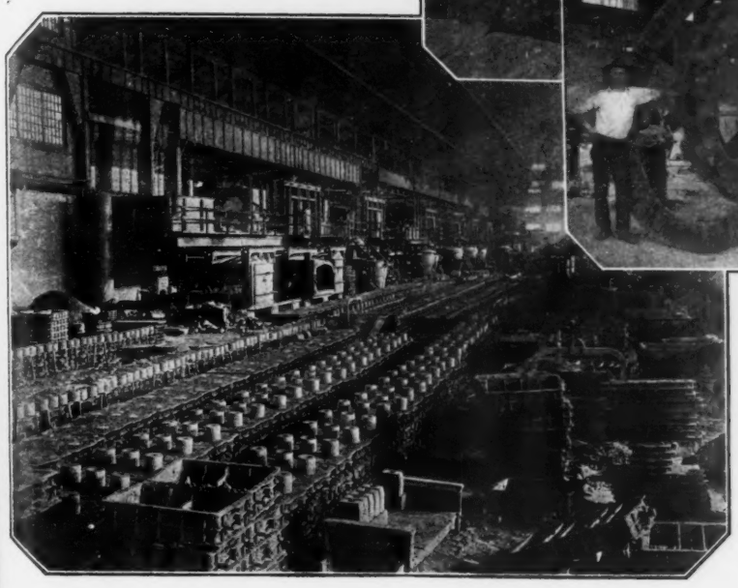
Ohio State University with over 7000 students is situated at the north end of High street. The building at the left is the gymnasium and armory. The cadet regiment numbers over 1800 men who are drilled under army officers

ctivity Will Attract Convention Visitors

Some foundries of unusual interest will be opened to visitors during the convention. The malleable shop of which an interior and yard view are shown is one of the best equipped in the state. Extensive welfare work is carried on by this company

A number of exceptional foundries in Columbus form departments of large industrial establishments. The one at the right supplies gray-iron castings for a mining machinery manufacturer





The two steel foundries of Columbus are exceptional. At the left is an exclusive railway castings shop, while above are shown some examples of large steel castings from a foundry making jobbing castings

types for elevating, conveying and power transmission purposes, portable truck and wagon loaders, crushers, pulverizers, shredders, portable limepulvers, and numerous other products for conserving human energy, lowering operating costs and increasing efficiency and production are manufactured.

The Jeffrey force of employes has its own building and loan association, mutual aid society, also co-operative employes restaurant, bakery and store where meals and goods may be obtained at cost. The Jeffrey company operates a gray-iron foundry.

A subsidiary of the Jeffrey company, and an establishment which will hold much of interest to the foundrymen attending the convention, is the Ohio Malleable Iron Co. This company is headed by J. A. Jeffrey, president. The other officers are J. Walter Jeffrey, vice president; C. W. Miller, secretary and treasurer; G. R. Kittle, general manager, and J. M. Kittle, assistant. The Ohio Malleable plant is one of the best equipped malleable shops in the state from the standpoint of labor saving appliances. From the clam-shell and magnet equipped cranes in the material yards to the loading cranes in the shipping department, every conceivable advantage is taken in substituting mechanical for human effort. Overhead charging cranes serve each air furnace, of which six are operated simultaneously. Steam and electric charging machines handle the annealing pots into and out of the ovens. Sand cutters, and monorails aid in preparing and handling the sand for daily use. As stated, the company operates six air furnaces every day. Each of these has a maximum capacity of 40 tons, and a monthly output of over 2000 tons is attained. When operating at full schedule, this shop employs about 1000 men, including 250 skilled molders. The company makes castings which average about 1 pound in weight. Over 40 per cent of the production goes to the Jeffrey Mfg. Co., while the remainder is taken by automobile and car manufacturers.

As in the case of the Jeffrey plant, co-operative stores are maintained where employes may buy groceries and general sundries at cost. A company restaurant across the street from the plant provides lunches for the men. During the recent housing shortage, the company purchased 26 acres of land and assisted its employes in financing homes.

Another leading malleable foundry of the city is the Columbus Malleable Iron Co. which was established in 1911, through a reorganization of the Columbus Malleable Castings Co. This foundry operates three 20-ton, coal-fired air furnaces and anneals in nine ovens utilizing the same fuel. Its average output is 400 tons per month, and consists of agricultural implement, automobile, car and medium weight jobbing castings. G. H. Thompson, who is well known throughout the malleable industry, is president, J. D. Price is vice president and G. A. Johnson is secretary and treasurer of the company.

Excells in Steel Casting

Columbus has only two steel foundries. These are the Bonney-Floyd Co. and the Buckeye Steel Castings Co. The Bonney-Floyd company is a particularly progressive institution. It has an average production of 12,000 tons per year, but under stress of war demands it has produced as high as 1400 tons of high grade steel castings in a single month. Castings are made ranging in weight from 1 pound to 10 or 11 tons. A 15-ton basic open-hearth furnace and three 3-ton converters supply the metal at the present time, and a new 3-ton Ludlum electric furnace is being installed. This unit probably will be in operation and open to inspection at the time of the convention. Every casting made in the plant is annealed. Five annealing furnaces, which are rigged to utilize either natural gas or oil fuel, are in service, and full pyrometric control is exercised.

The company manufactures general miscellaneous steel castings and its versatility is shown by a list of its products which includes castings for cranes, tractors, railway cars and locomotives, coal mining machinery, hydraulic presses, motors, pumps, crushing machinery, ship operating machinery, turbines, steam shovel and excavating equipment. During the war, in addition to supplying the demands of its regular customers, this company produced all steel castings entering into the construction of the so-called *Pershing* locomotives, castings for powder works, ship castings which met the Lloyds and American bureau specifications, and special steel billets for forging into shells. Over two-thirds of the output of the plant at present is taken by firms located outside of Columbus.

The Bonney-Floyd Co. was organized in 1906 by J. L. V. Bonney and W. B. Floyd. The plant started operations in 1907, coincident with the panic of that year, with a maximum capacity of 200 tons per month. That it has successfully survived and prospered is shown by its present large output and the fact that it has grown and expanded until its property now embraces about 17 acres of ground.

The Buckeye Steel Castings Co. originated with the old Buckeye Malleable & Coupler Co. Its first president was Maj. W. J. Goodspeed, who secured the services of S. P. Bush, the present president, as superintendent. When a federal law was passed requiring all couplers to be made of cast steel, a new plant was secured and the present business was established. This was about 1902. The company was one of the first to manufacture a patented steel coupler and this continued to be the principal product of the plant until 1906 or 1907 when the production of cast steel side frames and bolsters for railway freight cars was undertaken. The shop now is strictly a specialty foundry making these castings for railway service. About 2000 men are employed.

The introduction of Mr. Bush into the foundry business was rather unusual. He came to the Buckeye plant from the Chicago, Milwaukee & St. Paul railway, where he was superintendent of motive power at Milwaukee. Previously he had been with the Pennsylvania railway and had served his apprenticeship in the shops of that company in Columbus. Mr. Bush at present is president and general manager of the company; R. S. Warner, is first vice president; J. C. Whitridge, second vice president; and Arno Eberlein, secretary and treasurer. A. H. Thomas is superintendent of the foundry.

Columbus is a large center for gray-iron jobbing castings. One of the oldest firms engaged in this line of business is that of Henry Loudenslager which was established about 45 years ago. Henry Loudenslager, who died some years ago, originally was with the Gill car wheel foundry mentioned earlier in this article. At the age of 21, he became foreman for the Columbus Machine Co., and left this position to enter the foundry business for himself. At present his two sons operate the shop, which produces from 15 to 18 tons per day of castings weighing up to 6 tons, including general jobbing and municipal castings. Henry Loudenslager, Jr., is manager and he is assisted by his brother, Walter J. Loudenslager.

The Ebinger Sanitary Mfg. Co., employing about 100 men, makes bath tubs and fixtures, fountains and general plumbing castings in gray iron. The two stove shops of the city are C. Emrich and A. T. Nye & Son Co. The former employs about 100 men and manufactures stoves complete. The U. S. Cast Iron Pipe & Foundry

(*Concluded on page* 732)

Who and What to See at the Big Show

Total Floor Space Occupied, Variety of Product and Equipment Shown and Number of Manufacturers Participating Will Exceed All Previous Events of This Character

ABRASIVE INDUSTRY, Cleveland.—This booth will be fitted up as a rest room and visitors may consider this booth their headquarters while in attendance at the convention and exhibition. A large assortment of technical books will be on display. Represented by John A. Penton, A. O. Backert, J. D. Pease, C. J. Stark, F. V. Cole, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, E. L. Shaner, A. L. Klingeman, L. C. Pelott, S. H. Jasper, J. F. Ahrens and G. B. Howarth.

ACHESON GRAPHITE CO., Niagara Falls, N. Y.—This exhibit will consist of electric furnace electrodes; welding electrodes; graphite molds in which castings can be poured and foundry facings represented by Acheson Smith, H. P. Martin, L. C. Judson and Atwood B. Oatman.

AIR REDUCTION SALES CO., New York.—Demonstrations will be made of welding and cutting torches and a complete display of apparatus; oxygen and acetylene cylinders will be maintained; represented by A. S. Kinsey, A. R. Ludlow, L. A. Sholes, G. H. Crofton, H. H. Melville and A. D. Frost.

AJAX METAL CO., Philadelphia.—In addition to the customary line of ingots and castings will also exhibit a 60 kilowatt electric furnace; represented by G. H. Clamer, W. J. Coane, Frank M. Willeson, Louis E. Purnell, John G. Miller, James K. Wyatt, Donald H. Fairfield.

AKRON CULTIVATOR & MANUFACTURING CO., Akron, O.—Will show one and two wheel tubular barrows; patent charging barrows; contractors barrows and concrete carts; represented by H. W. Melvin, R. R. Roemer, C. E. Holcomb, and G. M. Winwood Jr.

AMERICAN BORON PRODUCTS CO., Reading, Pa.—This exhibit will consist of sample cases of alloys together with castings treated with these alloys; represented by J. Fred Smith, John Ramer and C. F. Molley.

AMERICAN FOUNDRY EQUIPMENT CO., New York.—This company plans to show sand cutting machine, sandblast room, sandblast barrel, cloth screen dust arrester, annealing oven charging truck, core machine, molding machine, corrugated steel flasks, aluminum snap flasks and pattern mounting compound; represented by Verne E. Minich, Elmer A. Rich, Hutton H. Haley, James Rigby Jr., Robert H. Kelly, Charles G. Smith, Jerome E. Sweet, C. B. Schneible, E. J. Turnbull, C. D. Steinmeier, David Logan, R. S. Buch.

AMERICAN HOMINY CO., Indianapolis.—Will exhibit and demonstrate a core binder which is manufactured as a by-product; repreesnted by George B. Hill, William R. Martin, Robert C. Herms and John A. Green.

AMERICAN LA FRANCE FIRE ENGINE CO., Pittsburgh.—Is arranging to exhibit a complete safety first line, showing such articles as safety signs, respirators, respirator masks and hoods, pure air supply apparatus, emergency breathing devices, gas filter masks, protective goggles, first aid supplies, mechanics' gloves, bulletin boards and blackboards, rubber gloves, asbestos clothing, gloves and leggings, safety nonexplosive cans, and safety portable lines. The company also is arranging to exhibit articles used for fire fighting equipment, such as sodas and acid extinguishers, carbon tetrachloride extinguishers, nozzles, hose, etc.; represented by R. C. Engels, T. A. Miller and H. J. Lovell.

AMERICAN MOLDING MACHINE CO., Terre Haute, Ind.,—Different types of molding machines including jolt rockover, jolt stripper, air and hand squeezers will be displayed; represented by W. C. Norcross, F. N. Perkins, and Thomas Marsh.

AMERICAN WOODWORKING MACHINERY CO., Rochester, N. Y.—Woodworking machinery for the pattern shop will be shown at the booth of this company; represented by Geo. Ely, R. T. Maston, and A. H. Jones.

ARCADE MFG. CO., Freeport, Ill.—The exhibit of this company will comprise eight different types of molding machines and also an installation showing the application of a patented pouring device; represented by E. H. Morgan, Charles Morgan, L. L. Munn, Henry Tschering, August Christen, G. D. Wolfley, R. E. Turnbull, and Mentor Wheat.

ASBURY GRAPHITE WORKS, Asbury, N. J.—Are planning to have several sand molds in their booth to demonstrate to practical foundrymen the difference in foundry facings. This feature has never been shown before and will be of particular interest to a great number of visitors, a collection of graphite ore also will be shown; represented by H. M. Riddle Jr. and others.

ASHLAND BRASS FOUNDRY, Ashland, O.—Expect to have a display of aluminum match plate pattern equipment; represented by Waldo Kauffman.

ATKINS, E. C., & CO., Indianapolis.—The exhibit of this company will include a metal band sawing machine, a new and improved type of hack saw machine, together with various other styles and types of standard saws and blades for all purposes; represented by T. A. Carroll, T. H. Endicott, Edward Norvel, B. D. Thompson, A. Mertz and Samuel P. Moore.

AUSTIN CO., Cleveland.—Will exhibit models, drawings, photographs, and literature on standard buildings, more especially of the foundry type. Information regarding foundry and steel plant service will be available. The models of buildings will be larger than those shown at previous conventions, and will be of sufficient size so that many of the minor details can easily be shown, thus affording minute inspection into methods and various types of construction; represented by O. D. Conever, G. A. Bryant, A. L. Chubb, C. F. Chard, and R. A. Curtis.

AUTOMATIC TRANSPORTATION CO., Buffalo.—Several types of automatic industrial tracks and tractors will be shown by this company. They will also exhibit some sub-assembly units, together with direct current charging equipment; represented by Russel J. Mulholland, George F. Simons, Clarence E. Ogden, Thomas F. Donahue, and O. H. Goodsell.

BACHARACH INDUSTRIAL INSTRUMENT CO., Pittsburgh, Pa.—A complete demonstration outfit for measuring the air blast in foundry cupolas will be shown; also recording meters used by some of the larger foundries for taking continuous chart records of the air blast; represented by L. J. Seedel.

BAKER BROS., Toledo, O.—Intend to exhibit a heavy duty boring and drilling machine and a newly designed 2-spindle drill; represented by Wallace Elliott, Herbert Tigges, George Hallenbeck and W. Baker.

BARRETT-CRAVENS CO., Chicago.

BARTLETT & SNOW, C. O., CO., Cleveland.

BASTIAN BLESSING CO., Chicago.

BAUER, A. E., & SON, Chicago.—A revolving knife wood trimmer will be shown at the booth of this company; represented by William E. Bauer and Walter E. Bauer.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y.—It is the intention of this company to exhibit a complete line of metallographic apparatus, that is, an apparatus for photographing polished and etched surfaces of iron, steel, brass, etc. A complete line of apparatus for this purpose will be exhibited in operation.

BEAUDRY & CO., Boston.—A ¼-size motor driven working model of a power hammer will be employed to demonstrate the scope and capacity of this form of equipment; represented by A. Parsons.

BERKSHIRE MFG. CO., Cleveland.—Besides automatic molding machines, air squeezer machines, combination jolt and squeeze machines, demonstrations will be given of vibrators, electric sand riddles, flasks, etc.; represented by W. D. Fraser, G. L. Cannon, J. A. Scott, J. E. Burke.

BESLY, CHAS. H., CO., Chicago.

BETHLEHEM STEEL CO., Bethlehem, Pa.—Expect to feature pig iron for special foundry purposes as produced at the Sparrow's Point plant; represented by Robert MacDonald and several other representatives who also will be there in connection with various general products produced by the company.

BEYER MACHINE CO., Jackson, Mich.—Will exhibit a rotary sand riddle of new design; represented by F. W. Beyer.

BIRKENSTEIN, S., & SONS, Chicago.—At this booth a full line of nonferrous metals will be shown including ingot brass, ingot copper, ingot bronze, pig tin, pig lead, aluminum, solder, manganese bronze, babbitt, phosphor tin, and phosphor copper. A display of castings made from these metals will also be shown; represented by Harry Birkenstein, George Birkenstein, Charles B. Raphael, Matt Schero, Herman Goldstine, Eli Brown, Louis Caviale, Sidney Pflaum, A. J. Smith.

BLACK & DECKER MFG. CO., The, Baltimore.

BLACK DIAMOND SAW & MACHINE WORKS, Natick, Mass.—Will exhibit a band saw filing and setting machine, motor driven; a circular saw filing machine, motor driven; a disc sander, motor driven; a spindle sander, motor driven; a band saw brazing outfit; ball-bearing band saw guides; represented by W. B. Ambler, Edward Gordon, and W. B. Freeman.

BLAW-KNOX CO., Pittsburgh.—Intend to exhibit one of their standard foundry clamshell buckets, water cooled furnace appliances, and will include by means of photographs or otherwise, display of their entire line of products, excluding those which would be of no special interest to the foundry trade; represented by J. H. Flynn and D. C. Grove.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—This company will show a regular sand mixer equipped with screen, motor and power discharge; represented by D. C. Smith, T. A. Graham and Luther G. Conroe.

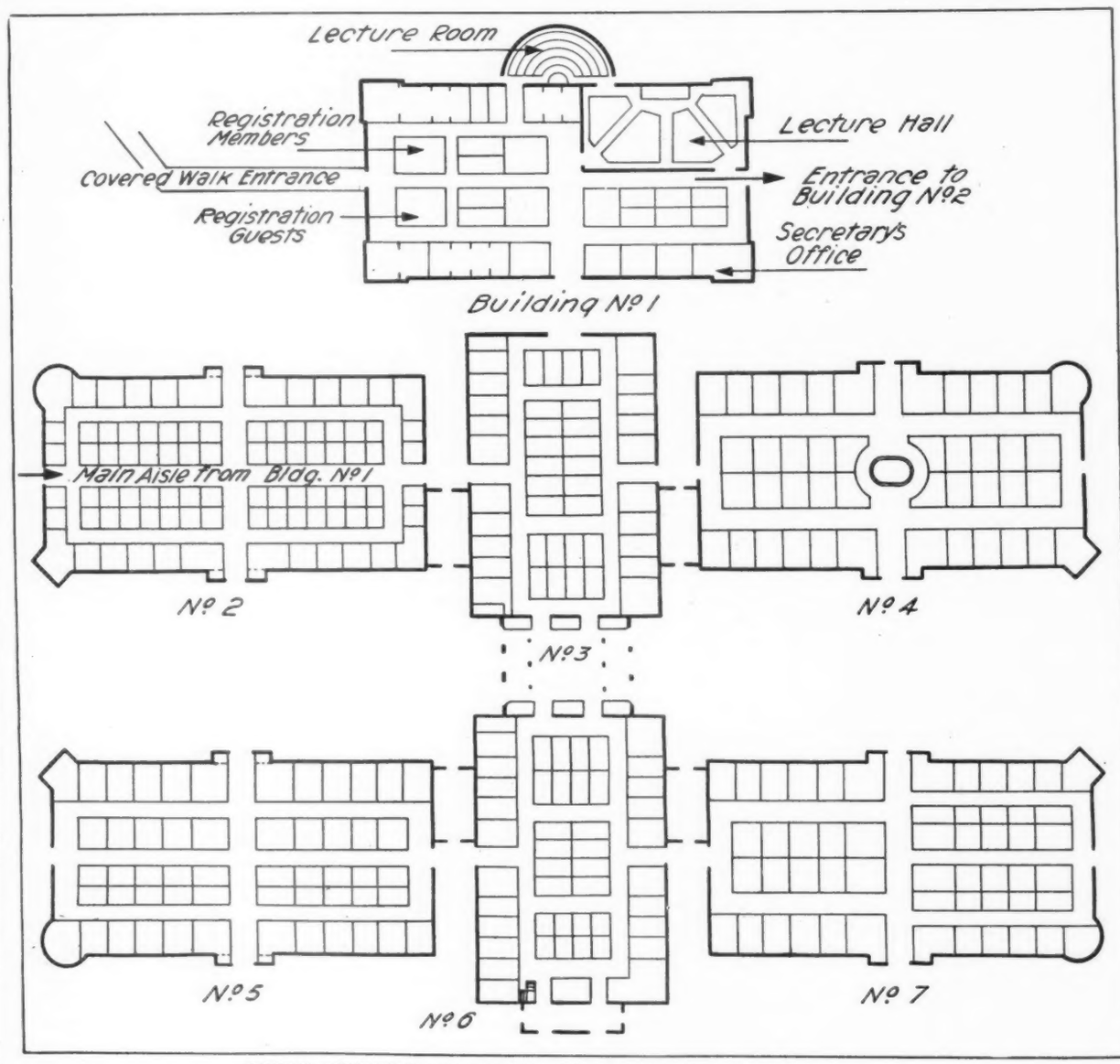
BOOTH ELECTRIC FURNACE CO., Chicago.—There will be on display a standard 1000-pound rotating electric furnace especially designed for melting nonferrous metals. This furnace will be equipped with automatic electrode control and motor will be connected so that furnace can be placed in rotation and all details explained to visitors. Photographs and other interesting data showing an electric conducting hearth furnace which is being used in melting steel, iron and other ferrous metals, will be shown and also castings and other products of the electric furnace; represented by C. H. Booth, D. E. Carpenter, M. A. Beltaire Jr., C. J. Goehringer, and Arthur Crabbe.

BRASS WORLD PUBLISHING CO., New York.

BRITISH ALUMINUM CO., LTD., London.—Will show standard ingots, both pure and in regular alloys of the various shapes supplied to the trade. Also samples of aluminum sheet, different gages and tempers and a selection from many hundred extruded moldings and sections. They will also have an interesting line of samples, showing the bauxite, cryolite and other raw materials, entering into

Where to Find Exhibitors at the Columbus Show

Building No.	Exhibitor	Address
3	*Abrasive Industry*	Cleveland
6	Acheson Graphite Co.	Niagara Falls, N. Y.
6	Air Reduction Sales Co.	New York
2	Ajax Metal Co.	Philadelphia
3	Akron Cultivator & Mfg. Co.	Akron, O.
1	American Boron Products Co.	Reading, Pa.
7	American Foundry Equipment Co.	New York
2	American Hominy Co.	Indianapolis
1	American LaFrance Fire Engine Co.	Pittsburgh
7	American Molding Machine Co.	Terre Haute, Ind.
5	American Woodworking Machinery Co.	Rochester, N. Y.
7	Arcade Manufacturing Co.	Freeport, Ill.
2	Asbury Graphite Mills	Asbury, N. J.
2	Ashland Brass Foundry	Ashland, O.
5	Atkins, E. C., & Co.	Indianapolis
1	Austin Co., The	Cleveland
2	Automatic Transportation Co.	Buffalo
2	Bacharach Industrial Instrument Co.	Pittsburgh
5	Baker Brothers	Toledo
3	Barrett-Cravens Co.	Chicago
3	Bartlett & Snow, C. O., Co.	Cleveland
6	Bastian Blessing Co.	Chicago
5	Bauer & Son, A. E.	Chicago
2	Bausch & Lomb Optical Co.	Rochester, N. Y.
2	Beaudry & Co.	Boston
7	Berkshire Manufactring Co.	Cleveland
5	Besly, Chas. H., Co.	Chicago
1	Bethlehem Steel Co.	Bethlehem, Pa.
7	Beyer Machine Co.	Jackson, Mich.
1	Birkenstein, S., & Sons, Inc.	Chicago
5	Black & Decker Mfg. Co., The	Baltimore
5	Black Diamond Saw & Machine Co.	Natick, Mass.
3	Blaw-Knox Co.	Pittsburgh
7	Blystone Mfg. Co.	Cambridge Springs, Pa.
6	Booth Electric Furnace Co.	Chicago
1	Brass World Publishing Co.	New York
2	British Aluminum Co., Ltd., The	New York
2	Brown Instrument Co.	Philadelphia
3	Buckeye Products Co.	Cincinnati
6	Campbell-Hausfeld Co.	Harrison, O
6	Carborundum Co., The	Niagara Falls, N. Y.
6	Caward-Gaskill Furnace Corp.	Chicago
7	Champion Foundry & Machine Co.	Chicago
2	Chase, Inc., Frank D.	Chicago
5	Chesapeake Iron Works	Baltimore
1	Chicago Crucible Co.	Chicago
4	Chicago Pneumatic Tool Co.	New York
1	Clark Meter Co., Chas. J.	Gladbrook, Iowa



GENERAL ARRANGEMENT OF BUILDINGS AT THE OHIO STATE FAIR GROUNDS

Where to Find Exhibitors at the Columbus Show

Building No.	Exhibitor	Address
2	Clark Tructractor Co.	Buchanan, Mich.
2	Cleveland Flux Co.	Cleveland
4	Cleveland Pneumatic Tool Co.	Cleveland
5	Clipper Belt Lacer Co.	Grand Rapids, Mich.
2	Coale Lumber Co., Thomas E.	Philadelphia
2	Combined Supply & Equipment Co.	Buffalo
2	Cooper Manufacturing Co.	York, Pa.
2	Corn Products Refining Co.	New York
4	Curtis Pneumatic Machinery Co.	St. Louis
3	*Daily Iron Trade and Metal Market Report*	Cleveland
7	Davenport Machine & Foundry Co.	Davenport, Iowa
6	Davis Bournonville Co.	Jersey City, N. J.
4	Dayton Pneumatic Tool Co.	Dayton, O.
6	Detroit Electric Furnace Co.	Detroit
1	Detroit Soluble Oil Co.	Detroit
2	Diamond Clamp & Flask Co.	Richmond, Ind.
1	Diamond Oil Co.	Philadelphia
5	Dings Magnetic Separator Co.	Milwaukee
5	Henry Disston & Sons, Inc.	Philadelphia
5	Divine Bros. Co.	Utica, N. Y.
2	Dixon Crucible Co., Joseph	Chicago
2	Stanley Doggett, Inc.	New York
6	Electric Furnace Co., The	Salem, O.
6	Electric Welding Machine Co.	Detroit
7	Federal Foundry Supply Co.	Cleveland
7	Federal Malleable Co.	West Allis, Wis.
1	Ferguson Co., H. K.	Cleveland
2	Firefoam Service & Supply Co.	Cleveland
2	Foreign Crucibles Corp., Ltd.	New York
3	FOUNDRY, THE	Cleveland
2	Foundry Equipment Co., The	Cleveland
5	Gardner Machine Co.	Beloit, Wis.
6	Geist Manufacturing Co.	Atlantic City, N. J.
3	General Electric Co.	Schenectady, N. Y.
2	Gordon, Inc., Robert	Chicago
7	Great Western Mfg. Co.	Leavenworth, Kans.
1	Great Western Smelting & Refining Co.	Chicago
7	Grimes Molding Machine Co.	Detroit
5	Gurney Ball Bearing Co.	Jamestown, N. Y.
6	Hardinge Co.	New York
2	Clement A. Hardy Co., The	Chicago
2	Hardy & Co., F. A.	Chicago
2	Harris & Co., Benjamin	Chicago
2	Haskins Co., R. G.	Chicago
6	Hauck Manufacturing Co.	Brooklyn
5	Haynes Stellite Co.	Kokomo, Ind.
5	Hayward Co.	New York
5	Heald Machine Co.	Worcester, Mass.
2	Hill-Brunner Foundry Supply Co.	Cincinnati
2	Hill & Griffith Co., The	Cincinnati
4	Hoevel Manufacturing Corp.	Jersey City, N. J.
1	Holland Core Oil Co.	Chicago
6	Humphreys & Co., E. C.	Chicago
4	Independent Pneumatic Tool Co.	Chicago
6	Industrial Electric Furnace Co.	Chicago
7	Ingersoll-Rand Co.	New York
7	International Molding Machine Co.	Chicago
2	Interstate Sand Co.	Zanesville, O.
3	*Iron Age, The*	New York
3	*Iron Trade Review, The*	Cleveland
1	Jennison-Wright Co.	Toledo, O.
1	Jones Sand Co.	Columbus, O.
2	Jurack Pattern Works, Charles	Milwaukee
2	Kawin Co., Chas. C.	Chicago
2	Keener Sand & Clay Co.	Columbus, O.
4	Keller Pneumatic Tool Co.	Chicago
1	Kellogg & Sons, Inc., Spencer	Buffalo
2	Kelly & Co., T. P., Inc.	New York
7	Kilbourne & Jacobs Mfg. Co.	Columbus, O.
6	King Refractories Co., Inc.	Buffalo
5	Kinsey Co., E. A.	Cincinnati
2	Knoeppel & Co., C. E., Inc.	New York
3	Lakewood Engineering Co.	Cleveland
1	Lane Co., Henry M.	Detroit
4	Lewis-Shepard Co.	Boston
2	Lindsay Chaplet & Mfg. Co.	Philadelphia
3	Link Belt Co.	Chicago
7	Locke Pattern Works	Detroit
4	Louden Machinery Co.	Fairfield, Iowa
5	Lucas Machine Tool Co.	Cleveland
5	Ludlum Steel Co.	Watervliet, N. Y.
2	Lupton's Sons Co., David	Philadelphia
3	McCormick Co., J. S.	Pittsburgh
2	McLain's System	Milwaukee
5	*Machinery*	New York
1	MacLean Publishing Co.	Toronto, Ont., Canada
4	Macleod Company, The	Cincinnati
5	Magnetic Mfg. Co.	Milwaukee
6	Mahr Manufacturing Co.	Minneapolis
7	Malleable Iron Fittings Co.	Branford, Conn.
2	Marden, Orth & Hastings Co., Inc.	New York
6	Maxon Furnace & Engineering Co.	Muncie, Ind.
7	Menefee Foundry Co.	Fort Wayne, Ind.
2	Mercury Mfg. Co.	Chicago
2	*Metal Industry*	New York
5	Metal Saw & Machine Co.	Springfield, Mass.
6	Metal & Thermit Corp.	New York
2	Michigan Smelting & Refining Co.	Detroit
6	Milburn Co., Alexander	Baltimore
3	Monarch Engineering & Mfg. Co.	Baltimore
4	Mott Sand Blast Mfg. Co.	Brooklyn
7	Mumford Molding Machine Co.	Chicago
3	National Engineering Co.	Chicago
2	National Scale Co.	Chicopee Falls, Mass.
7	Nicholls Co., Wm. H., Inc.	Brooklyn, N. Y.
5	Norma Co. of America	Long Island City, N. Y.
5	Norton Co.	Worcester, Mass.
3	Obermayer Co., S.	Chicago
4	Ohio Body & Blower Co., The	Cleveland
2	Ohio Equipment Co.	Cleveland
2	Ohio Metal Co.	Columbus, O.
4	Oldham & Son Co., George	Philadelphia
5	Oliver Machinery Co.	Grand Rapids, Mich.
7	Osborn Mfg. Co.	Cleveland
5	Osborne & Sexton Machinery Co.	Columbus, O.
6	Oxweld Acetylene Co.	Chicago
1	Paine & Co.	Wilkes-Barre, Pa.
4	Pangborn Corporation	Hagerstown, Md.
3	Paxson Co., J. W.	Philadelphia
3	Penton Publishing Co.	Cleveland
1	Pickands Brown & Co.	Chicago
2	Pittsburgh Crushed Steel Co.	Pittsburgh
7	Porcelain Enamel & Mfg. Co.	Baltimore
4	Portage Silica Co.	Youngstown, O.
7	Pridmore, Inc., Henry E.	Chicago
6	Quigley Furnace Specialties Co.	New York
5	Racine Tool & Machine Co.	Racine, Wis.
5	*Railway Mechanical Engineer*	Chicago
3	Raymond Bros. Impact Pulverizer Co.	Chicago
3	Richards-Wilcox Mfg. Co.	Aurora, Ill.
1	Robinson & Co., Dwight P.	New York
2	Rogers, Brown & Co.	Cincinnati
3	Roots Co., P. H. & F. M.	Connersville, Ind.
1	Safety Equipment Service Co.	Cleveland
2	Safety First Shoe Co.	Providence, R. I.
5	Simonds Mfg. Co.	Fitchburg, Mass.
3	Sly Mfg. Co., W. W.	Cleveland
2	Smith & Sons Co., R. P.	Chicago
2	Smith Co., Werner G.	Cleveland
6	Spencer Turbine Co.	Hartford, Conn.
4	Standard Equipment Co.	New Haven, Conn.
7	Standard Sand & Machine Co.	Cleveland
4	Sterling Wheelbarrow Co.	West Allis, Milwaukee
2	Stevens, Frederic B.	Detroit
	Stodder, W. F.	Syracuse, N. Y.
4	Sullivan Machinery Co.	Chicago
2	Superior Sand Co.	Cleveland
6	Torchweld Equipment Co.	Chicago
5	Thomas Elevator Co.	Chicago
7	Teetor Co., R. J.	Muskegon, Mich.
1	Truscon Steel Co.	Detroit
2	United Compound Co.	Buffalo
2	United States Graphite Co.	Saginaw, Mich.
7	U. S. Molding Machine Co.	Cleveland
2	United States Silica Co.	Chicago
6	U. S. Smelting Furnace Co.	Belleville, Ill.
1	Vibrating Machinery Co.	Chicago
2	Wadsworth Core Machine & Equipment Co.	Akron, O.
5	Wallace & Co., J. D.	Chicago
5	Warner & Swasey Co.	Cleveland
6	Wayne Oil Tank & Pump Co.	Fort Wayne, Ind.
5	Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.
1	Westinghouse Traction Brake Co.	Pittsburgh
6	Wheeler Mfg. Co., F. H.	Chicago
2	White & Bro.	Philadelphia
2	Whitehead Bros. Co.	Buffalo
5	Whiting Foundry Equipment Co.	Harvey, Ill.
5	Whitman & Barnes Mfg. Co.	Akron, O.
4	Woodison Co., E. J.	Detroit
2	Wood's Sons Co., T. B.	Chambersburg, Pa.
5	Wright Manufacturing Co.	Lisbon, O.
3	Young Bros. Co.	Detroit

the production of aluminum; represented by Ernest V. Pannell and Arthur Jellinek.

BROWN INSTRUMENT CO., Philadelphia.—Will display a complete line of temperature measuring instruments, including high resistance indicating and recording pyrometers and thermometers for core oven temperatures; high and low resistance portable pyrometer, for molten metal temperatures of brasses, bronzes, aluminum; indicating and recording pyrometers for heat treating and annealing steel castings; for malleable iron oven temperatures, for case hardening etc.; also all kinds of temperature measuring instruments, instruments for indicating and recording pressures, speeds, time and operation, etc.; represented by G. W. Keller, G. L. Clapper, O. L. Larson, D. L. Mathias, and R. L. Kent.

BUCKEYE PRODUCTS CO., Cincinnati.—The exhibit of this company will consist of nonferrous metal melting furnaces, oil, gas and electric, portable core drying ovens, ladle heating devices, compressed air and electric sand riddles of the latest design, patented snap flask guides and flask accessories; also various products consisting of parting compounds, general foundry facings, core compounds, fluxes, high temperature furnace cements, core oils, as well as miscellaneous items of improved foundry equipment and appliances; represented by Charles J. Goehringer, Edgar O. Stamm, Dwight S. Marfield, C. M. Marcellus, D. A. Williston, G. W. Zimmerman, C. L. Gysin, H. Kunkemoeller, C. P. Stamm, D. E. Carpenter.

CAMPBELL-HAUSFELD CO., Harrison, O.—Will have the following list of exhibits; Noncrucible tilting melting furnaces; lever tilting crucible furnace No. 125 capacity crucible, gear tilting crucible furnace for No. 150 capacity crucible, aluminum tilting melting furnaces, using cast iron melting pot, capacity 100 lbs. and 300 lbs. of aluminum, stationary crucible furnace taking up to No. 90 crucible; all the furnaces are designed to operate on natural or artificial gas, fuel oil or kerosene, ladle and crucible pre-heaters for natural or artificial gas, combination knee and foot air vibrators, ingot stands, ingot molds, skimmers, etc.; represented by Edwin B. Hausfeld, Joseph E. Hausfeld, John S. Armour.

CARBORUNDUM CO., Niagara Falls, N. Y.—Will exhibit abrasive wheels, paper and cloth, disks, grains, rub stones, hones, etc., manufactured from both carborundum and aloxite. Also various special and standard shapes carborundum refractory material, together with furnace linings of fire sand and examples of carborundum refractory cement applications; represented by C. E. Hawke, George Chorman, R. C. Bradbury, Leonard Pitt, O. C. Dobson, and A. A. Lees.

CAWARD GASKILL-FURNACE CORP., Chicago.—Will exhibit one stationary type for size 60 crucible melting furnace; one tilting type for a No. 150 crucible melting furnace; one oscillating type quarter ton size, open flame melting furnace, non-crucible and non-retort; represented by O. M. Caward.

CHAMPION FOUNDRY & MACHINE CO., Chicago.—An electric sand riddle and core jolt rollover machine in operation will be on exhibition at the booth of this company; represented by T. J. Magnuson, H. O. Magnuson, Anton Magnuson.

CHASE, FRANK D., INC., Chicago.—Photographs, drawings and illustrations of modern foundry plants designed and built by the company will be shown at the exhibition booth; represented by Frank D. Chase, Morris W. Lee, L. M. Hansen, and F. I. Robertson.

CHESAPEAKE IRON WORKS, Baltimore.—Will make a comprehensive exhibit and display illustrating the merits and special features of its electric traveling crane as applied especially in foundry and to other heavy yet delicate work. The crane will be operated by a trained man from the company's works at Baltimore who will demonstrate the crane's efficiency especially in foundry service. The display will also include a feature illustrating the character of the great variety of steel structures and bridges that it has fabricated and which have been erected throughout the United States. Exhibits also will be presented illustrating the company's mechanical and electrical shop equipment for building steel structures, bridges, cranes, etc.; represented by F. S. Chavannes, C. H. Michel, J. W. Waters, C. S. Hill Jr., Frank L. Perry, Joseph Hoff, Charles R. Lambert, C. A. Sticht, E. F. Morgan, C. S. Kirk and J. Wade Miller.

CHICAGO CRUCIBLE CO., Chicago.—A complete assortment of graphite crucibles will be shown at the booth of this company; represented by L. C. Taylor, J. P. Foraker and J. W. Mann.

CHICAGO PNEUMATIC TOOL CO., New York.—Special educational devices have been worked out by the engineers of the company and the exhibit will comprise the most complete and comprehensive display which they have ever installed. The products displayed will include pneumatic motor driven air compressor in operation supplying air for an operating display of riveting, chipping and calking hammers, sand rammers in all sizes, air drills, grinders and casting cleaners, pneumatic geared hoists in all sizes. There also will be an interesting display of electric drills and grinders and a wide variety of pneumatic and electric tool accessories manufactured by the company. Represented by H. A. Jackson, A. E. Goodhue, W. H. Callen, A. C. Andersen, T. G. Smallwood, B. M. Stewart, Ross Watson, R. F. Eissler, R. W. Rose, A. E. Conroe, and H. C. Gilligan.

CLARK METER CO., CHAS. J., Gladbrook, Iowa.

CLARK TRUCTRACTOR CO., Chicago.—Will have on exhibition four models of its truck as follows: One hand hoist end dump, one locomotive or tractor type, one automatic end dump, one tructractor chassis only. Three reels of industrial motion picture film will also be shown. These films show the machine at work in various foundries, factories and industrial plants; represented by H. K. Trask, L. J. Schneider, E. W. Clark, and representatives of the W. W. Williams Co., Columbus.

CLEVELAND FLUX CO., Cleveland.—A complete line of the fluxes made by the company, together with descriptive matter, etc., relative to their use will be shown. While there will not be any actual demonstration of the fluxes yet they hope to have a miniature cupola describing just how and when these fluxes are used. They are putting up a very complete exhibit as well as a very attractive one; represented by Clifford B. Cornell.

CLEVELAND PNEUMATIC TOOL CO., Cleveland.—Will have on exhibition a complete line of pneumatic foundry tools also other tools not directly used in foundries but in kindred lines that are associated in construction work with the foundry, and foundry sand rammers for floor, bench and core ramming, foundry portable grinders for grinding castings in iron and steel foundries, foundry core breakers, for removing cores from large castings, foundry air drills in all types, foundry chipping hammers in several sizes adapted for light and heavy work in malleable iron, gray iron and steel castings. There will also be on exhibition a complete line of pressure seated air valves for air pipe lines in sizes used between air compressors and air tools and a complete line of air hose couplings in all sizes adapted for foundry service. The exhibition this year will be very much finer than any shown at previous conventions; represented by H. S. Covey, Arthur Scott, C. D. Garner, A. E. Ahern, R. C. Disgue, and J. T. Graves.

CLIPPER BELT LACER CO., Grand Rapids, Mich.—Three different types of belt lacing machines, together with various sizes of special hooks for joining belt ends will be shown at this booth, represented by R. S. Moore.

COALE, THOS. E., LUMBER CO., Philadelphia.—The exhibit will consist of lumber for pattern and flask purposes, the same as displayed at previous shows. A full line of this material will be so arranged that the foundryman can readily find what suits his particular needs; represented by Thomas E. Coale and S. D. Pettit.

COMBINED SUPPLY & EQUIPMENT CO., INC., Buffalo.—Will show a complete line of standard and special chaplets and skim gates; represented by Stephen LeViness Jr. and C. L. Jackson.

COOPER MFG. CO., York, Pa.—Will have on exhibition at their booth samples of ore compound, core paste and silica clay for steel foundries; represented by C. F. Cooper, W. H. Fitzpatrick, and C. J. Dickey.

CORN PRODUCTS REFINING CO., New York.—The exhibit will consist of a display of cores of various kinds, also an electric oven which will be operated by a practical foundryman, making and baking cores for observation; represented by J. A. Oates, F. G. Faller Jr., D. T. McGrory, J. M. Remmes, and A. H. Kreischer.

CURTIS PNEUMATIC MACHINERY CO., St. Louis.—Will display a double cylinder, single acting, water cooled, sight feed, splash oiling air compressor; 100 cubic feet air per minute capacity. The compressor will be mounted on base with electric motor, short belt drive with idler and belt tightener. It will be equipped with water circulating pump for forced circulation of cooling water. It also will be equipped with automatic compressor unloader which operates and holds open the suction valves when the desired pressure is obtained, allowing the compressor to run with open cylinders until the pressure has fallen a few pounds; compressor does not operate against a vacuum when unloaded. All working parts of the compressor enclosed in a dust proof case. A double I-beam trolley on top hand operated bridge crane, equipped with air hoist, mounted in trunnions on trolley will also be exhibted, hoist to be air balanced for foundry control; also a bracketed single I-beam, jib crane, equipped with pendant air hoist, air balanced type, having foundry control. The entire exhibit will be operated at all open hours of the exhibition; represented by Joseph Macksey and members of the sales force.

THE DAILY IRON TRADE AND METAL MARKET REPORT, Cleveland.—This booth will be fitted up as a rest room and visitors may consider this booth their headquarters while in attendance at the convention and exhibition. A large assortment of technical books will be on display. Represented by John A. Penton, A. O. Backert, J. D. Pease, C. J. Stark, F. V. Cole, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, E. L. Shaner, A. L. Klingeman, L. C. Pelott, S. H. Jasper, J. F. Ahrens and G. B. Howarth.

DAVENPORT MACHINE & FOUNDRY CO., Davenport, Iowa.—Will exhibit two 24-inch jolt roll over draw molding machines, one 24-inch jolt stripper and one jolt squeezer; represented by A. D. Ziebarth.

DAVIS-BOURNONVILLE CO., Jersey City, N. J.—The exhibit will comprise a wide range of equipment for oxyacetylene and oxyhydrogen welding and cutting, including acetylene pressure generators, electrolyzers for the generation of oxygen and hydrogen, tube welding machines, with new developments in multiple flame tube welding tips, several exclusive machines for cutting with oxyacetylene and oxyhydrogen torches, including the portable radiograph, oxygraph, pyrograph for cutting flanged boiler heads, camograph for cutting hand holes and similar openings in boiler plate, and a complete line of welding and cutting torches, regulators and auxiliary equipment; represented by H. R. Swartley Jr., J. L. Anderson, H. H. Dyar, J. C. Glaum, M. S. Plumley, W. W. Barnes, and a corps of expert operators.

DAYTON PNEUMATIC TOOL CO., Dayton, O.—Will display the very latest types of both bench and floor rammers, together with riveters and chippers. This company has made some very marked improvements in these tools recently and will have something of interest to show the trade at this convention; represented by A. B. Hilton Jr., L. B. George, G. C. Towle, A. B. Clausen, F. G. Baldwin, E. C. Thompson, and a number of district salesmen.

DETROIT ELECTRIC FURNACE DO., Detroit.—This company will show one of their standard type "C" 2000-pound capacity electric furnaces. The furnace will be set up for mechanical operation but no actual melting will be performed; represented by Ed. L. Crosby, H. M. St. John, A. E. Rhoads, F. L. Kavanaugh and other members of the organization.

DETROIT SOLUBLE OIL CO., Detroit.—It is the intention of this company to demonstrate by means of actual cores the application of its various core oils and binders. Represented by A. H. Pearson, F. N. Tweedy, F. L. Roades and F. Bolsley.

DIAMOND CLAMP & FLASK CO., Richmond, Ind.—Exhibit will consist of several standard and master type flasks, steel jackets, bands, pattern makers benches, varnish cans, and a complete line

of foundry accessories; represented by E. A. Kinley and F. J. Gurtsiele.

DIAMOND OIL CO., Philadelphia.

DINGS MAGNETIC SEPARATOR CO., Milwaukee.—This company will show three machines in operation. One of these will be a magnetic separator used for reclaiming iron from gray iron, steel and malleable foundry refuse. Another will be a typical magnetic pulley type separator with bilge boards and deflecting boards, and a third will be a new development in the foundry industry. This latter machine is used for extracting iron from brass and bronze turnings; represented by A. H. Ackermann, J. E. Randall, P. R. Hines, and R. A. Manegold.

DISSTON, HENRY, & SONS, Philadelphia.—At this booth power hack saws and the sectional interlocked inserted tooth circular milling saws will be shown in actual operation. The interlocked milling saw is a patented design that has been developed by this company especially for cutting metal of irregular shapes, hard steel rails, risers and gates from steel castings, general structural steel work, etc. The teeth in this saw are so arranged that six teeth are absolutely locked in place with one wedge; this makes it possible to place the teeth close together, doing away with chattering caused by the wide spacing. Besides the saws in operation, the company will show metal slitting saws, milling saws, hand and power hack saw blades, screw slotting saws, and files of all kinds; represented by Messrs. Dorrington, Bardsley and Newman, and L. L. Mather.

DIVINE BROS. CO., Utica, N. Y.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—Will show a complete line of crucibles for every purpose. Literature covering every phase of crucible manufacture and use will be distributed; represented by D. A. Johnson, H. C. Sorenson, E. A. St. John, R. R. Bellville, R. F. Leonard, L. S. Stapp, M. M. McNaughton, and A. L. Haasis.

DOGGETT, STANLEY, INC., New York.—Propose to exhibit samples of special parting and facing material and other foundry facings and supplies; represented by Stanley Doggett, Stanley H. Doggett, and Henry A. Roffman.

ELECTRIC FURNACE CO., Alliance, O.—This exhibit occupying two booths will consist, first of a 50-kilowatt tilting-type electric furnace for melting brass and aluminum, together with the necessary switch and transformer; second, numerous copper and brass castings which have been produced in foundries which employ electric furnaces for melting their nonferrous metals; third, moving pictures showing the furnaces in actual operation, both for melting nonferrous metals and for heat treating and annealing; represented by R. F. Fletcher.

ELECTRIC WELDING MACHINE CO., Detroit.

FEDERAL FOUNDRY SUPPLY CO., Cleveland.—Will exhibit a line of molding machines and specialties; represented by Ralph Ditty, Elsworth Kaye, W. J. Smith, John Bayer, W. A. Gluntz, G. A. Fuller, T. H. Terry, C. A. Collins, T. R. Ditty.

FEDERAL MALLEABLE CO., West Allis, Wis.—At this booth will be shown one stationary squeezer, one portable squeezer and one jolt squeezer. These machines will be supplied with air and operated. They are planning to use several rather unique patterns in this connection and have prepared a set of patterns for soil pipe fittings and expect to show the soil pipe manufacturers something new in this line of molding; represented by W. J. MacNeill, G. J. Mead, and F. J. Bannach.

FERGUSON, H. K., CO., Cleveland.—The exhibit of the company will comprise models of foundry and machine shop buildings and others devoted to various uses. The booth will be decorated with photographs illustrating the scope of their activities and literature on the subject will be distributed; represented by E. Darrow and L. H. Butler.

FIREFOAM CO. OF OHIO, Cleveland.—Will show the following products: Forty-gallon chemical engine, 2½-gallon extinguishers, 3-gallon fire pail, 1-quart extinguishers, a complete line of safety cans and accessories. Demonstration will be shown at the booth and motion pictures will be shown of the company's product and appliances in action on various types of fires; represented by D. H. Reedy and E. E. O'Neill.

FOREIGN CRUCIBLES CORP., LTD., New York.—This exhibit will consist of a line of both brass melting and steel melting French graphite crucibles; represented by R. N. Stevens.

THE FOUNDRY, Cleveland.—This booth will be fitted up as a rest room and visitors may consider this booth their headquarters while in attendance at the convention and exhibition. A large assortment of technical books will be on display. Represented by John A. Penton, A. O. Backert, J. D. Pease, C. J. Stark, F. V. Cole, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, E. L. Shaner, A. L. Klingeman, L. C. Pelott, S. H. Jasper, J. F. Ahrens and G. B. Howarth.

FOUNDRY EQUIPMENT CO., Cleveland.—Will have no equipment on exhibition. The booth will be fitted up as a rest room and will be decorated with photographs showing the company's activities; represented by F. A. Coleman.

GARDNER MACHINE CO., Beloit, Wis.—Will exhibit the following: Single and vertical spindle disk grinders; heavy duty disk grinder; polishing lathes; disks and accessories; represented by W. B. Leishman, W. L. Townsend, F. M. Risler, and E. L. Beisel.

GEIST MFG. CO., Atlantic City.—At this booth will be shown a piece of equipment for preheating castings that are to be welded; represented by Carlton Geist.

GENERAL ELECTRIC CO., Schenectady, N. Y.—An electric welding demonstration will be given in this space, other equipment will include a compressor driven by a 30 horse power 220-volt induction motor complete with compensator. The remainder of the space is to be used as general reception headquarters for General Electric customers; represented by C. T. McLoughlin, C. F. King, B. L. Spain, W. J. Snyder, K. Tsuda.

GORDON, ROBERT, INC., Chicago.—One of the heaters made by this company, equipped with an oil heater, will be kept in full operation during the exhibition; represented by T. H. Monaghan, H. H. Engle, J. L. Zimmerman, R. M. Zimmerman, C. H. Woodison.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—This company proposes to exhibit various types of gyratory foundry riddles, also renewable bottom sieves for riddles; represented by F. A. Pickett, P. L. Wilson, George W. Combs.

GREAT WESTERN SMELTING & REFINING CO., Chicago.—Will exhibit a panel showing views of its various plants and branch warehouses throughout the world. The exhibit, itself, will be decorated and furnished along the lines of a reception room in a dwelling to entertain friends and acquaintances; represented by J. B. Neiman, H. J. Henry, B. J. Lippert, E. Q. Newman, S. M. Marks, I. N. Perlstein, Arthur Fritschle, H. L. Green, Mitchell Jacobs.

GRIMES MOLDING MACHINE CO., Detroit.—The company will exhibit molding machines, including a jar-ram, rollover machine of 1000 pounds lifting capacity, and a hand-ram, rollover machine with a rapidly operated pattern-change device; represented by G. L. Grimes, L. V. Grimes, C. J. Skeffington and T. M. McEuen.

GURNEY BALL BEARING CO., Jamestown, N. Y.—This exhibit will comprise a ball bearing journal box, adapted to be mounted in any standard shaft hanger. Also a ball bearing friction countershaft. The bearings used in this will be of the radio thrust type, adapted to carry both the radial loads and the thrust due to throwing in and out of the clutch; also ball bearings and adapters showing details of construction; represented by John T. R. Bell, J. H. Baninger, H. C. Marsh, D. K. Hatch, George C. Warner, H. C. Replogle.

HANNA ENGINEERING WORKS, Chicago.—Is planning to exhibit the following equipment: Rock over molding machine; 12-inch air jolt squeeze split pattern machine; 10-inch high trunnion jolt squeeze machine; 10-inch high trunnion squeeze machine; 5/8-inch, ¾-inch, 1-inch and 1½-inch vibrators; ¼, ½ and 1-ton trolleys; pneumatic hoists; suction oiler, vertical and universal types; two ⅞-inch small tripod shakers; represented by P. W. Gates, E. C. Welborn, A. F. Jensen, W. P. Krause, J. C. Hanna, J. O. Clark, O. P. Weiss and W. H. Huelster.

HARDINGE CO, New York—Will show a patent conical mill with particular reference to its utility in the field of grinding and pulverizing of brass ashes, foundry wastes, mattes, slags, foundry facings, etc, both wet and dry. Working glass models will be used to illustrate the action of the mill; represented by James G. Parmelee and G. F. Metz.

HARDY, CLEMENT A., CO., Chicago.—This exhibit will consist of photographs and drawings of foundries which have been built and equipped by the company.

HARDY, F. A., & CO., Chicago.—A list of safety appliances which may be described as "everything for safety" will be shown at the booth of this company; represented by C. A. Kingsbury.

HARRIS BENJAMIN, & CO., Chicago.—At this booth will be shown red and yellow brass ingots, represented by Louis Goldman, William M. Rosenthal, Max Goldman, Dean F. Carscadden.

HASKINS, R. G., CO., Chicago.—The equipment shown at this booth will include portable tools, flexible shafting and machinery for grinding, polishing and drilling; represented by Fred J. Neubauer Co.

HAUCK MFG. CO., Brooklyn, N. Y.—Will exhibit a complete line of oil burning equipment for foundry use, such as portable and stationary ladle dryers; mold dryers; cupola lighters; crucible melting furnaces; crude, fuel and kerosene oil hand torches for general foundry use; furnace burners of all descriptions; complete oil burning outfits for converting coke and coal core baking ovens to fuel oil; a new blue flame kerosene burner for large and small ovens; blue flame stove for pattern shops; rivet and tool dressing forges; represented by A. E. Hauck, J. D. Moore, A. H. Stein, H. H. Kress, and F. E. Giersch.

HAYNES STELLITE CO., Kokomo, Ind.

HAYWARD CO., New York.

HEALD MACHINE CO., Worcester, Mass.—This company will exhibit a cylinder grinding machine, a motor drive internal, a motor drive small size internal and a motor drive rotary surface grinder, together with magnetic chucks and other accessories. The chuck will be shown in a water tank which demonstrates the water-proof qualities of a magnetic chuck; represented by J. F. Pflum, Mr. Heald, Mr. Massey and Mr. Johnson.

HILL-BRUNNER FOUNDRY SUPPLY CO., Cincinnati.—The booth for this company will be fitted up and furnished as a rest and meeting room for the convenience of friends and acquaintances; represented by Bruce Hill, M. Z. Fox, R. H. Mills, and John Hill.

HILL & GRIFFITH CO., Cincinnati.—A full line of foundry facing, equipment, platers, polishers and foundry supplies will be shown at this booth; represented by E. R. Ritter, William Oberhelman, P. L. Ritter, Fred J. Brunner, T. R. King, Robert B. Ferguson, J. J. Mayou Jr., J. H. Lyle, George H. Kersting, E. W. Sample.

HOEVEL MFG. CORP., Jersey City, N. J.—Will show sandblast barrel machine, sandblast table machine and sandblast room, furthermore, drawings, photographs and other descriptive material of their complete line of sandblast and allied equipment; represented by H. F. Hoevel, L. B. Passmore, J. Miller, and F. Welte.

HOLLAND CORE OIL CO., Chicago.—Various grades of core oils, parting compounds and dry core compounds will be shown, also photographic views of foundries in which these products are used; represented by H. L. Baumgardner, G. W. Doty, H. A. Whiting, S. Dykstra, J. B. McDonough.

HUMPHREYS, E. C., & CO., Chicago.—Will show a complete line of molding sand for iron, brass and steel castings; they will also have an attractive display of other materials which they handle, including iron ore and refractory materials of all kinds; represented by J. F. Mackin, C. E. Louis, and J. B. Eppink.

INDEPENDENT PNEUMATIC TOOL CO., Chicago.—Will show a complete line of pneumatic tools, consisting of foundry chipping hammers; floor and bench hammers; hoists; air separators; pneumatic drills; and electric drills. The pistol grip and air separator are new; represented by W. A. Nugent.

S. W. Lanhan, W. R. Gummere, H. F. White, V. W. Robinson and Adolph Anderson.

INDUSTRIAL ELECTRIC FURNACE CO., Chicago.—The principal feature of this exhibit will be a simple improved type of electric melting and refining furnace of 300 pounds capacity operating directly on a 220-volt motor circuit without transformers. It is suitable for melting and refining ferrous and nonferrous metals, any metals that can be worked in cupola, open hearth, air furnace, crucible or other electric furnace. The remainder of the exhibit will comprise various pictures illustrating furnaces of several different types in operation; represented by F. von Schlegell, W. B. Lewis, W. B. Cooley, and L. C. H. Groeger.

INGERSOLL-RAND CO., New York.—In addition to a representative type of air compressor this company will also show a complete line of pneumatic tools, including motor hoists, sand rammer, riveting hammers, drills, grinding and cleaning machines, pneumatic hose couplings, etc.; represented by George J. Gallinger, Walter Johnson, W. A. Armstrong, George C. Williams, A. A. Anderson, and J. W. Anderson.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—An entire line of machines consisting of squeezers, jolt squeezers, stripping squeezers, plain stripping plate machines, combination jolt strippers, plain jarring machines and combination turnover machines of several different designs will be presented to visiting foundrymen; represented by Edward A. Pridmore, W. W. Miller, F. W. Hamel, E. G. Borgnis.

INTERSTATE SAND CO., Zanesville, O.—This exhibit will consist of molding sand of all grades for iron, steel, brass, and aluminum castings; represented by E. M. Ayers and L. K. Brown.

IRON AGE, THE, New York.

IRON TRADE REVIEW, THE, Cleveland.—This booth will be fitted up as a rest room and visitors may consider this booth their headquarters while in attendance at the convention and exhibition. A large assortment of technical books will be on display. Represented by John A. Penton. A. O. Backert, J. D. Pease, C. J. Stark, F. V. Cole, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, E. L. Shaner, A. L. Klingeman, L. C. Pelott, S. H. Jasper, J. F. Ahrens and G. B. Howarth.

JENNISON-WRIGHT CO., Toledo, O.—The exhibit of this company will consist of photographs, etc., showing the adaptability of their wood blocks to foundry floors represented by A. W. Sharp.

JONES SAND CO., Columbus.—This company will exhibit a full line of iron, brass, aluminum and stove plate molding sands; represented by N. M. Jones.

JURACK PATTERN WORKS, CHARLES, Milwaukee.

KAWIN, CHAS. C., CO., Chicago.—This booth will be fitted up as a rest room and meeting place for their clients to visit, rest and possibly discuss some of their shop troubles; represented by Charles C. Kawin, John F. Nellis, J. H. Hopp, R. F. Main, James Jordan, A. M. Knight, C. B. Teeter, H. P. Kreulen.

KEENER SAND & CLAY CO., Columbus—This company expects to display a full line of foundry sands, fire brick, and clay; represented by H. A. Keener and C. P. Helmick.

KELLER PNEUMATIC TOOL CO., Chicago.—Will exhibit a complete line of foundry hammers, floor sand rammers and bench sand rammers with both straight and pistol grip handles, valveless and corliss valve drills and grinders, chisels, accessories, etc.; represented by William H. Keller, L. H. Olsen, W. H. Woody, T. D. Slingman, C. A. Bremmer, J. B. Corby, C. Humphrey, L. J. Wakefield, J. N. Stebbins.

KELLOGG, SPENCER & SONS, INC., Buffalo.—Booths No. 15 and No. 21, Building No. 1 are to be used for display of cores and castings, and also samples of different grades of core oil; represented by W. L. Goetz, A. P. Mason, J. N. Yaeger, E. G. Allen, E. L. Journeay, H. J. Strassberger.

KELLY, T. P., & CO., INC., New York.—The booth of this company will be fitted up as a rest room and meeting place; represented by Ray Sullivan, E. L. Schenck, and V. J. Rohe.

KILBOURNE & JACOBS MFG. CO., Columbus, O.

KING REFRACTORIES CO., INC., Buffalo.

KINSEY, E. A., CO., Cincinnati.—Will display three machines. Two of these machines will be operated by demonstrators. One will be a No. 2 high duty drilling machine, the other will be a horizontal boring machine. They will also have a 10-inch power squaring shear in the exhibit; represented by W. J. Miller, Dan M. Martin and A. I. Brokaw.

KNOEPPEL, C. E., & CO., INC., New York—Will have exhibited a model control board on which will be shown a graphic control installation, set up for actual foundry operations; represented by Irving A. Berndt and other staff members.

LAKEWOOD ENGINEERING CO., Cleveland.—The exhibit of this company will consist of tier-lift truck, tractor and trailers, rocker dump car, and platform car. It is also planned to show photographs of the company's equipment in use in foundries; represented by O. W. Stiles, W. A. Meddick, W. S. Miller, and R. M. Jones.

LANE, H. M., CO., Detroit.—This exhibit will comprise photographs and drawings of foundries which have been designed and laid out by the company; represented by H. M. Lane, John A. Rathbone, A. O. Thomas, Benjamin Towlen, C. R. Seabrook.

LEWIS-SHEPARD CO., Boston.

LINDSAY CHAPLET & MFG. CO., Philadelphia.—A complete line of standard chaplets will be shown at this booth. Also special chaplets adapted to engine castings (automobile, gas engine, tractor) pumps, railroad castings (bolster and side frame castings); represented by Stanley B. Wentz and Herman E. Mandel.

LINK-BELT CO., Chicago.—A revivifier for molding sand will be shown in operation at this booth, also an electric hoist and a silent chain drive. Other interesting features will be enlarged photographs of foundries in which the company's equipment has been installed; represented by A. G. J. Rapp, R. B. Kern, E. C. Berghoefer, and J. S. Watson.

LOCKE PATTERN WORKS, Detroit.—Will have a complete display of modern pattern equipment for automobile, truck, tractor, airplane and farm implements; represented by D. H. Locke, E. A. Fleming, and David Bruce.

LOUDEN MACHINERY CO., Fairfield, Iowa.—This company has engaged spaces Nos. 415, 416, 425 and 426 on which they expect to make a complete display of overhead track and trolley equipment for foundries, mills, warehouses, etc. The exhibit will consist of tracks, trolleys, switches, hand operated traveling cranes, swinging jib cranes, coal carriers, special hoists, special trolleys, etc.; represented by L. E. Gaston, William Buhl, J. P. Lawrence, C. E. Beattie, J. K. Davis, L. F. Berthold.

LUCAS MACHINE TOOL CO., Cleveland.—A 50-ton power forcing press designed for straightening steel and malleable castings will be shown at this booth; represented by F. P. Sprague.

LUDLUM STEEL CO., Watervliet, N. Y.

LUPTON'S, DAVID, SONS' CO., Philadelphia.—Will show samples of various products, including pivoted factory sash, a short run of Pond Continuous Sash with storm panels at each end, this line of sash will be equipped with Pond Operating Device showing actual width opening, Lupton Counter-Balanced Sash, steel partition, steel tube door, cross section drawings showing installation in some remarkable heat-producing buildings throughout the country of large size, also enlarged photographs of these installations; represented by Clark P. Pond, C. F. P. Buckwalter, R. A. Sanborn, William Pfleider, George J. Wagner.

McCORMICK, J. S., CO., Pittsburgh.—Among the exhibits of this company will be one facing and core sand mixer, one electro magnetic separator, one pattern letter machine, one pneumatic blacking mixer, also sundry supplies; represented by J. S. McCormick, T. E. Malone, S. R. Costley, E. M. Lewis.

McLAIN'S SYSTEM, INC., Milwaukee.—Will show semisteel liberty motor, gas, oil, engine pistons and cylinders, gears, bushings, etc., containing 20 to 50 per cent steel. Sample castings of annealed semisteel with a tensile strength of 55- to 70,000 pounds per square inch. Also steel castings made in McLain-Carter open hearth furnaces; represented by David McLain, I. V. Scanlan, and Fred Smith.

MACHINERY, New York.

MACLEAN PUBLISHING CO., Toronto, Ont., Canada.

MACLEOD CO., THE, Cincinnati, O.—Sand blast equipment, dust arresters, portable oil burners, and ladle dryers will be shown at this booth; represented by O. P. Gwinner, A. A. Anderson, Walter Macleod.

MAGNETIC MFG. CO., Milwaukee.—Will have on exhibition two types of magnetic separators for brass foundries, a magnetic separator for gray iron, malleable iron and steel foundries, also magnetic pulley type separator; represented by R. H. Stearns and G. H. Fobian.

MAHR MFG. CO., Minneapolis.—This company will exhibit foundry torches for mold drying, cupola lighting, ladle drying, etc., ladle dryers and heaters, oil fuel rivet forges, annealing furnaces and other oil and gas burning equipment; represented by W. G. Barstow, C. M. Simonds, and H. H. Keeler.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—An operating exhibit of all sizes of vibrators, sprayers and accessories made by the company will be shown at this booth, also a core bench in operation and a model of a new buggy ladle; represented by G. B. Pickop and Frank Boskey.

MARDEN, ORTH & HASTINGS, New York.—At this booth will be shown samples of liquid and powdered sand binder, together with cores bonded with this material; represented by G. N. Moore and A. L. Milner.

MAXON FURNACE & ENGINEERING CO, Muncie, Ind.—Will exhibit and demonstrate fumeproof cover brass furnace and furnace linings, also a special line of burners and oil pumps.

MENEFEE FOUNDRY CO., INC., Fort Wayne, Ind.—A number of pattern mounts that have been in use for several years on molding machines will be shown, also a practical demonstration of how these pattern mounts are made; represented by James William Menefee and Earl H. Menefee.

MERCURY MFG. CO., Chicago.

METAL INDUSTRY, New York.

METAL SAW AND MACHINE CO., INC., Springfield, Mass.—A machine for cutting steel of various kinds will be kept in operation during the entire exhibition; represented by M. T. Workman and H. F. Blanchard.

METAL & THERMIT CORP., New York.—Will have a display of various metals and alloys as produced by the alumino-thermic process. Important alloys such as those used in the production of high speed steel will also be shown. One special feature will be an exhibition of pure tungsten powder in tablet form. Transparencies and photographs will illustrate welding on heavy mill machinery and general repairs; represented by A. F. Braid, H. G. Spilsbury, W. R. Hulbert, and H. D. Kelley.

MICHIGAN SMELTING & REFINING CO., Detroit.—The exhibit will contain samples of brass and bronze ingots, billets and slabs, babbitt metals, solders, lead pipes, die castings, and brazing spelter; represented by John R. Searles, Norman Silliman, Henry Levitt, R. H. Evans, Charles Bloomgarden, and Charles T. Bragg.

MILBURN, ALEXANDER, CO., Baltimore.—Are setting up a working exhibition, showing acetylene generators for welding, oxyacetylene welding and cutting torches, new types of acetylene regulating devices, and kindred apparatus. The generators range from 60-pound capacity, mounted on portable trucks, to large central installations for the commercial production, storage and distribution of gas for welding and cutting purposes. The company's unique combination welding and cutting torch, which both cuts and welds with equal facility, will be continuously demonstrated during the exhibition. Other blow-pipes and torches from the smallest jeweler's size up to the largest commercial torches will also be exhibited. A new regulator for the control and delivery of acetylene, oxygen, hydrogen, and various other gases will be exhibited for the first time. The regulator is smaller in size, more compact, of fewer parts, and much greater accuracy than former types. A large number of other apparatus, such as preheating burners, powerful portable acetylene lights

will be on exhibition: represented by J. A. Schleicher, D. Bartlett, C. E. Mitchell and E. P. Boyer.

MONARCH ENGINEERING & MFG. CO., Baltimore.—Will show the following equipment: One 1-ton motor driven revolving non-crucible furnace, one 600-pound crucible furnace, one double chamber, non-crucible furnace, one No. 150 crucible tilting coke furnace, one No. 125 crucible tilting gas furnace and motor blower, one No. 40 crucible stationary gas furnace, one vertical tilting oil or gas furnace, without crucibles, one No. 80 stationary crucible preheater air furnace, oil, one permanent mold machine (for brass and iron castings), one ladle heater, oil and gas, one oil pump, one positive pressure blower, core oven, oil, one core oven, coke, oil or gas; represented by H. D. Harvey, James J. Allen, Frank Maujean, James V. Martin, and William Raber.

MOTT SAND BLAST MFG. CO., INC.—One 8-foot revolving table, two different size tumbling barrels and an 8-foot dust arrester will be shown in operation at this booth every day; represented by David Mayer, E. J. Rosenthal, William Fischer, E. C. Gilmour, R. E. Donnelly, and P. R. Jones.

MUMFORD MOLDING MACHINE CO., Chicago.

NATIONAL ENGINEERING CO., Chicago.—Will exhibit one 6-foot diameter pan mixer which will be shown in actual operation, also one 4-foot diameter and 3-foot diameter mixers.

NATIONAL SCALE CO., Chicopee Falls, Mass.—Among the exhibits of this company will be a scale counting machine, elevating truck, call system and shelving, also a 500 series, dormant type counting machine, three bench type, complete installation of call system, from three to five stacks of steel stock bins and stock filing cabinet, universal lift truck and scale elevating truck; represented by E. C. Steele, Mrs. Steele, Mr. Trezevant, Mr. Mercer, Mr. White, and Mr. Schattinger.

NICHOLLS CO., WM. H., INC., Brooklyn, N. Y.

NORMA CO. OF AMERICA, New York.—This company will have a moving exhibit demonstrating the speed and silence at which their bearings operate; represented by R. E. Hecker, T. J. Harley, and D. E. Batesole.

NORTON CO., Worcester, Mass.—The exhibit of this company will consist of alundum and crystolon grinding wheels, grinding wheel stands, and refractories.

OBERMAYER, S., CO., Chicago.—Will exhibit small equipment, such as core ovens, sprue cutters, tumbling barrels, etc.; represented by S. T. Johnston, C. M. Barker, J. L. Cummings, J. E. Evans, William Fenton, William Fitzpatrick, E. D. Frohman, J. J. McDevitt, O. C. Olson, O. J. Peterson, A. N. Wallin.

OHIO BODY & BLOWER CO., Cleveland.—Will show a low temperature baking oven, portable racks, air separator, air trap and rotary ball bearing ventilator; represented by T. D. Johnson and at least one other of their direct men.

OHIO EQUIPMENT CO., Cleveland.—This exhibit will consist of lift trucks, the latest design in core racks, automatic dial scales, and the gasoline shop mule. Material handling equipment of the latest design will also be shown; represented by W. R. Englehart, E. M. Abramson, Ed. Stuebing, and E. A. Thiele.

OHIO METAL CO., Columbus, O.

OLDHAM, GEORGE, & SON CO., Baltimore.—Will display a full line of chipping hammers, foundry rammers, core busters, scalers, riveters, holders-on, and jam riveters, together with a line of pattern gouging tools. The tools will be available for operation so that visitors can note the powerful cutting ability and smooth action; represented by C. H. Lyle, J. T. Biles, and F. R. Fraser.

OLIVER MACHINERY CO., Grand Rapids, Mich.—Nine varieties of woodworking machine tools will be shown in the space allotted to this company; represented by A. S. Kurkjian, M. D. Baldwin, R. F. Baldwin, James R. Duthie, Arthur Blake, C. A. Ginter, G. C. Conklin, W. F. Reading, J. E. McLauchlen, Dolph de Young, Arie Steenbergen.

OSBORN MFG. CO., Cleveland.—A comprehensive list of molding machines will be shown by this company including direct draw roll over jolt machines; combination power jolt stripper squeezer machine, large type; combination jolt stripper machines, small type, not power driven; plain air squeezer machines; air squeezer jolt machines, several small roll over machines. Many of these machines will be equipped with patterns and the making of molds will be demonstrated; represented by H. R. Atwater, J. C. Alberts, E. J. Byerlein, E. S. Carman, Ward Daughterty, H. E. Deakins, E. T. Doddridge, E. W. Jacobi, R. E. Kiefer, H. A. Potter, F. T. Spikerman, P. F. Troyan.

OSBORNE & SEXTON MACHINERY CO., Columbus, O.—In addition to a lathe and shaper made by the company there also will be shown several tools made by other manufacturers; represented by C. A. Fisher.

OXWELD ACETYLENE CO., Chicago.—Will exhibit an oxweld low pressure generator and oxweld welding and cutting apparatus and demonstrate the application of their equipment. In addition they will demonstrate the cutting of cast iron; represented by L. E. Ogden, G. Hettrick, T. Gillespie, C. E. Downey, Carl Olson, R. J. Kehl, H. C. Mace, J. C. Reid, G. F. Schmid.

PAINE & CO., Wilkes-Barre, Pa.—It is the intention of this company to put an oven in its booth for making cores; it also will make a display of oil binders. The booth will be fitted up with chairs for a rest room; represented by J. W. Shotts and James F. Besecker.

PANGBORN CORP., Hagerstown, Md.—Castings in various sizes and metals will be cleaned daily with exhibit of castings, forgings, heat treated parts, enameled work, etc., before and after sand-blast treatment. One section will be comfortably furnished and supplied with drawings, literature, etc., for convenience of interested foundrymen, with photographs of different types of equipment as actually installed in prominent plants throughout the country; represented by Thomas W. Pangborn, John C. Pangborn, W. C. Lytle, Jesse J. Bowen, George H. Cooley, Charles T. Bird, P. J. Potter, James F. Tracey, Roy C. Koch, W. A. Allbright, A. G. Hauck, John Abbott, H. D. Gates, Hugo F. Liedtke, and Foster J. Hull.

PAXSON CO., J. W., Philadelphia.—Will exhibit various lines of molding sands and supplies. Equipment will be represented by drawings and photographs; represented by H. M. Bougher and I. F. Kremer.

PENTON PUBLISHING CO., THE, Cleveland.—The complete list of periodicals published by this company will be on display, including THE FOUNDRY, *The Iron Trade Review*, the *Daily Iron Trade and Metal Market Report*, *Abrasive Industry*, *Marine Review* and *Power Boating*. In addition this company will exhibit a large number of technical books. Represented by John A. Penton, A. O. Backert, J. D. Pease, C. J. Stark, F. V. Cole, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, E. L. Shaner, A. L. Klingeman, L. C. Pelott, S. H. Jasper, J. F. Ahrens and G. B. Howarth.

PICKANDS, BROWN & CO., Chicago.—In connection with the Semet-Solvay Co., expect to make an attractive display of Solvay foundry coke; represented by R. S. Dutton, Thomas W. Glasscot, J. A. Galligan, F. L. Schulze, George A. T. Long, W. H. Ball, and James A. Ballard.

PITTSBURGH CRUSHED STEEL CO., Pittsburgh.—This exhibit is to be conducted under the auspices of the "Metallic Abrasive Manufacturers' Association of America." The association will exhibit metallic abrasives for sand-blasting and will show samples of steel grit, the sharp angular abrasive and of chilled shot the globular abrasive; represented by G. H. Kann, H. M. Ream, N. C. Harrison, R. S. Kann.

PORCELAIN ENAMEL & MFG. CO., Baltimore.—Expect to demonstrate genuine porcelain enamel application on cast iron.

PORTAGE SILICA CO., Youngstown, O.—Will consist of samples of conglomerate silica rock in its natural state, and samples of various grades of sand blast, steel molding and core sands; represented by E. E. Klooz and L. R. Farrell.

PRIDMORE, HENRY E., Chicago.—Will have the following molding machines in operation with patterns and flask, and will make molds on each machine: 30-inch combination, jolt, roll-over equipped with cylinder pattern, 26 x 24-8-inch drop power rock-over drop machine equipped with pattern and flask, 16 x 20-inch combination jolt strip equipped with pattern and flask, 16 x 14-5-inch drop rock-over machine with pattern and flask, 14 x 14-inch, square-stand, machine equipped with cope pattern, 10-inch, jolt squeezer with pattern and flask; represented by Mrs. E. M. Pridmore, Henry A. Pridmore, George Furman, Henry G. Schlichter, Marshall E. Pridmore, Hebert Behrens, D. F. Eagan, C. H. Ellis, J. W. Dopp, J. A. Patterson, and Hugh Gallagher.

QUIGLEY FURNACE SPECIALTIES CO., New York.—Exhibit comprises demonstration and photographs of high temperature cement and a highly refractory fire sand for bonding refractory materials including its use for furnace linings, cupolas, foundry ladles and for manufacture of special shapes and rammed in linings as well as repairs to furnace structures, an air transport system for preparing, distributing and burning powdered coal will be shown by means of photographs; represented by W. S. Quigley, J. H. McPadden, F. W. Reisman, H. H. Harris, W. A. Toohill, and W. C. Bell.

RACINE TOOL & MACHINE CO., Racine, Wis.—A motor driven high speed metal cutting machine and probably a new slotting machine of the milling type will be shown; represented by W. R. Reinhardt, A. H. Goetz, F. J. Kidd.

RAILWAY MECHANICAL ENGINEER, Chicago.

RAYMOND BROS. IMPACT PULVERIZER CO., Chicago.—Will show a model roller mill which is being used so extensively nowadays for powdering coal used in the foundry industry. This mill will be in operation, grinding coal to illustrate the fineness and uniformity of the product, also how well the mill operates and how dustlessly it handles the material; represented by Joseph Crites and F. I. Raymond.

RICHARDS-WILCOX MFG. CO., Aurora, Ill.—A number of models will be shown at this booth to illustrate the advantages and general features of conveying equipment; represented by A. J. Eggleston, E. J. G. Phillips, Frank H. Wente, and J. A. White.

ROBINSON, DWIGHT, & CO., Buckhill Falls, Pa.—Convention will be attended by foundry engineers who will exhibit photographs of foundries designed and constructed by the company.

ROGERS, BROWN & CO., Cincinnati.—The company's booth this year will be equipped with a large map electrically operated showing the location of its various sources of supply, such as blast furnaces, coke, fluorspar, iron ore and magnesite districts; J. C. Mears, St. Louis; A. O. Sonne, Chicago; L. E. McClaren, Chicago; S. W. Hubbard, Cleveland; C. P. Hellwig, Cleveland; T. A. Wilson, Pittsburgh; C. D. Shepard, Pittsburgh; F. J. Waldo, Buffalo; A. F. Stengel, Buffalo; R. T. Melville, Buffalo; W. R. Maher, Boston; R. W. Clark, New York; G. R. Sullivan, Philadelphia; S. B. Morison, Philadelphia; F. W. Bauer, Cincinnati; A. J. Wentworth, Cincinnati; F. I. Teal, Cincinnati; L. W. Hoefinghoff, Cincinnati, F. W. Miller, Cincinnati; J. R. Morehead, Cincinnati.

ROOTS CO., P. H. & F. M., Connersville, Ind.—Will show the first Roots blower ever constructed and also an up-to-date machine of small size, a small blower and small gas pump; represented by H. M. Papworth, C. C. Abbott, E. D. Johnston.

SAFETY EQUIPMENT SERVICE CO., Cleveland.—Exhibit comprises goggles for chipping, grinding, welding, dust, smelters, acid; a complete line of hospital equipment; gas and electric sterilizers; a complete line of first aid supplies and accident kits; bulletin boards; shaft oilers; belt sticks; carboys; set screws; safety cans; machine guards; individual towels and drinking cups; sanitary drinking fountains; wash stands; lavatories; playground equipment; safety clothing made of asbestos; rubber; leather; fire, water and acid-proofed material, including coats, suits,

pants, gloves, mittens, leggins, aprons, a garment for every industrial use; respirators, shields, hoods, masks, helmets for dust, sand-blasting, babbitting and welding; emery wheel, jointer and shaper guards; signs and tags for that danger, caution or warning spot; represented by B. W. Nutt, B. Frank; H. L. Wood, and T. P. Scully.

SAFETY FIRST SHOE CO., Providence, R. I.—This company will show two lines of shoes specially designed along safety lines for use in foundries and other industries of a like character; represented by Edgar C. Davidson.

SIMONDS MFG. CO., Fitchburg, Mass.—Will have a working exhibit demonstrating metal cutting-off saws. The special feature of the exhibit is an inserted tooth metal cutting saw, different sizes of which are shown and operated on the machines. These saws are made with high speed steel cutting teeth fitted into a carbon plate. Different size teeth are made for cutting different materials and give different widths of cutting kerf. The exhibit also includes files and hack saw blades made by this company; represented by H. B. McDonald, G. R. Bird, and H. Baumann.

SLY, W. W., MFG. CO., Cleveland.—Will show a 2-section drawer type core oven complete in every detail; represented by W. C. Sly, E. J. Moore, D. E. Hadley, P. W. Graue, S. H. Baird, F. A. Ebeling, and G. K. Fanner.

SMITH, R. P., & SONS, Chicago.—Will confine their exhibit to a display of safety shoes for molders and foundrymen; represented by J. B. Smith Jr.

SMITH, WERNER G., CO., Cleveland.—This exhibit will consist of samples of core oils of their own manufacture, specimen cores made with their oils, and castings in which cores made with their oils were used; represented by Werner G. Smith, Frank H. Dodge, Milton S. Finley, A. L. Robinson, William E. Rayel, Louis F. Ferster, J. C. DeVenne, Norman A. Boyle, F. K. Sawyer, John Scheuer, Charles G. Cook, and W. R. Collette.

SPENCER TURBINE CO., Hartford, Conn.—The exhibit will consist of the Spencer turbo-compressors as used for foundry cupola blowing, and for supplying air for oil and gas burning furnaces; represented by H. M. Grossman and S. E. Phillips.

STANDARD EQUIPMENT CO., New Haven, Conn.—Will exhibit radial blast barrels in three sizes and one standard cinder mill. The radial blast barrel and the cinder mill will be in operation daily; represented by C. A. Dreisbach, C. S. Johnson, F. Washburn and J. R. Sheldon.

STANDARD SAND & MACHINE CO., Cleveland.—Will show a standard facing and core sand mixer; represented by H. E. Boughton.

STERLING WHEELBARROW CO., Milwaukee.—This exhibit will consist of a large and most attractive display of rolled steel flasks, special foundry wheelbarrows, and other specialties, such as shop boxes, trucks, skim gates, wedges, etc.; represented by I. R. Smith, H. H. Baker, A. E. Welch, R. F. Jordan, J. J. Coyne, J. M. Dickson, O. E. Steep, G. H. Lambkin, J. W. Dopp, J. M. Patterson, Herman Kalthoff, Leo Hartwell, and E. C. Mueller.

STEVENS, FREDERIC B., Detroit.

STODDER, W. F., Syracuse, N. Y.—Will show a suction sand blast nozzle designed to eliminate the use of pressure tanks; represented by W. F. Stodder and M. A. Stodder.

SULLIVAN MACHINERY CO., Chicago.—Will exhibit one of its angle compound belt-driven air compressors. This machine will be operated by a 75-horsepower General Electric motor and will supply air, as at previous expositions, for other exhibitors at the foundry show, will be equipped with standard end rolling finger type of plate valve. The Sullivan exhibit will also include one 10 x 10 straight line, single stage belt driven air compressor, enclosed working parts and splash system of lubrication, one auger drill used for breaking cores in foundries, also a utility forge hammer for miscellaneous light forging; represented by R. T. Stone, E. T. Wells, H. T. Walsh, and S. B. King.

SUPERIOR SAND CO., Cleveland.—Samples of molding sand suitable for all classes of castings in iron, brass, steel, aluminum, etc., will be shown at the booth of this company; represented by W. H. Smith and H. C. Koontz.

TEETOR CO., R. J., Muskegon, Mich.

THOMAS ELEVATOR CO., Chicago.—Will exhibit a line of wrenchless chucks; represented by A. W. Boldebuck and J. J. Moore.

TORCHWELD EQUIPMENT CO., Chicago.—Will show a complete line of torchweld products, such as welding apparatus, cutting apparatus, preheating apparatus, and everything that interests the metal welding industry. Many new features in cutting equipment will be introduced, including a machine welding torch, a machine cutting torch, and also a number of new ideas for increasing the efficiency and economy of these particular items; represented by W. A. Slack, H. R. Fenstemaker, C. J. Nyquist, and George Smedley.

TRUSCON STEEL CO., Youngstown, O.—The exhibit will consist of pressed steel foundry flasks; a pressed steel platform for lift trucks; photographs and layouts of various types of industrial buildings, and side wall steel windows, top hinge continuous monitor steel sash and a tension operating device.

UNITED COMPOUND CO., Buffalo.—This exhibit will comprise samples of the material and also demonstrations of its application; represented by John W. Bradley and L. F. Leney.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—The exhibit will consist of a display of graphite and graphite products for the foundry trade. They are planning on making a practical demonstration of foundry facing and expect to have something in the way of a souvenir for distribution to the trade at this gathering; represented by H. F. Gump, Charles H. Schenck, J. G. Drought, C. D. McIntosh, R. J. Edmiston, and A. S. Harvey.

U. S. MOLDING MACHINE CO., Cleveland.—Expect to exhibit a number of molding machines, including plain air squeeze machine, jar and squeeze machine, jar squeeze pattern drawing, jar squeeze roll over, jar pattern drawing machine, jar roll over pattern drawing, plain jar machine. All of the machines will be operated making molds; represented by J. N. Battenfeld, J. L. Battenfeld, C. F. Battenfeld, and Harold Klinkler.

UNITED STATES SILICA CO., Chicago.—This exhibit will comprise samples of flint shot for sand blasting and flint silica for steel molding and core making, also samples of castings produced with these materials, also printed matter regarding plant operation and results obtained by flint shot; represented by Volney Foster, Lewis B. Reed, H. F. Goebig, and Oliver Cook.

UNITED STATES SMELTING FURNACE CO., Belleville, Ill.—Rotary melting furnaces for melting brass, bronze, aluminum; for smelting and refining work and for melting vitreous enamels will be shown in capacities of 200, 400, 1000 and 2000 pounds; represented by Arthur Jones.

VIBRATING MACHINERY CO., Chicago.—Will have a complete battery of special electrical sand sifters in operation during the show; represented by Julius Schroeter and William Lindsay.

WADSWORTH CORE MACHINE & EQUIPMENT CO., Akron, O.—Booths occupied by this company will be more in the form of a reception room or office. It is proposed to exhibit but not demonstrate, special 3-spindle motor driven core making machine; also 1½-inch core cutting off and coning machine, for cutting off and coning cores from ½-inch to 4 inches, and quite a few various sizes of all steel core drying plates and bottom plates; represented by George H. Wadsworth, M. C. Sammons, and L. L. Crane.

WALLACE, J. D., & CO., Chicago.—Will have an exhibit of the 4-inch bench planer, 6-inch bench jointer, universal bench saw, plain bench saw, and a 14-inch bench band saw; represented by J. D. Wallace, H. L. Ramsay, D. H. Shartle, Henry Imshang, and James Stewart.

WARNER & SWASEY CO., Cleveland.—Machine tools will be shown at this booth including a universal hollow hexagon turret lathe, motor driven, with Lavoie air chuck, shown in actual operation; and a double friction back geared turret lathe, motor driven, also with Lavoie air chuck, holding a cone gear, with operating time of from 3 to 3½ minutes each; represented by R. G. Buyer, C. E. Neubert, C. B. Phillips, and L. K. Berry.

WAYNE OIL TANK & PUMP CO., Fort Wayne, Ind.—Will exhibit oil burning furnaces for brass melting of both the tilting noncrucible and crucible types; represented by S. D. Rickard, A. P. Hitzeman, and E. B. Lipsett.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa.—The exhibit of this company includes one 150 kilowatt synchronous generator, three single phase 60-cycle transformers, one 175 ampere single operator welding unit, also several types of motors, controllers, switches, shields, electrode holders, adapters, lenses, etc.; represented by W. H. Patterson, W. W. Reddie, A. M. Candy, F. D. Egan, and G. H. Jaspert.

WESTINGHOUSE TRACTION BRAKE CO., Pittsburgh.—Expect to have on exhibition the following apparatus: Air compressors, motor and steam driven; detail accessories, such as pressure governors, cutout cocks, operating and control valves, air reservoirs, etc.; represented by F. C. Young, S. A. King, M. H. Burchard, L. M. Pease, O. H. Miller, and J. B. Wright.

WHEELER, F. H., MFG. CO., Chicago.—Will show a complete line of protective apparel, spring knee leggins; springless leggins and hip leggins; spats, asbestos gloves, lined and unlined; asbestos mittens; one finger mittens; aprons; and complete line of wearing apparel, with many new articles and general improvements of the whole line; represented by F. H. Wheeler, E. L. Wheeler, and G. E. Pratt.

WHITE & BROS., INC., Philadelphia.—This exhibit will consist of casting copper-composition and bronze ingot metals, manganese bronze, yellow brass ingot metals, babbitt metals, and all nonferrous ingot metals; represented by Frank Krug, Raymond Hunter, Horace Krider, L. D. Kluver, and Frederick A. Reinhardt.

WHITEHEAD BROS. CO., Buffalo.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—One worm geared crane ladle of 4000-pound capacity, one iron charging car of 4000-pound capacity, one tumber, 30 x 48, one model of trolley will be shown at this booth; represented by R. H. Bourne, A. H. McDougall, G. P. Fisher, R. S. Hammond, A. W. Gregg, and R. E. Prussing.

WHITMAN & BARNES MFG. CO., Akron, O.—Will display drills and reamers of all types and will have a grinding machine in the booth for the purpose of showing how to properly grind drills; represented by George R. Hume, R. A. Ammon, H. E. Fisher, George D. Ceska, H. Z. Callender, and H. B. Garske.

WRIGHT MFG. CO., Lisbon, O.—The line of exhibit will include chain hoists and trolleys; represented by S. J. Woodworth, R. C. Blair, H. F. Wright and H. H. Wright.

WOODISON, E. J., CO., Detroit.—The exhibit will include a full line of molding machine and core making machines, core box drawing machines, core blowing machines, crucible and iron pouring devices, back bone wax fillet, foundry supplies, facing, and platers and polishers' supplies and compositions; represented by E. J. Woodison.

WOOD'S, T. B., SONS CO., Chambersburg, Pa.—Will exhibit equipment for the Wood system of taper snap molding, comprising the Peerless Patented Tapered Snap Flask and Automatic Adjustable Patented Snap Jacket. Flasks and jackets will be shown in various sizes adapted for a wide range of snap work; represented by Charles M. Wood and Victor Lesher.

WRIGHT MFG. CO., Lisbon, O.

YOUNG BROTHERS CO., Detroit.—This exhibit will show a two-compartment rack type core oven, duplicating an Indiana installation. One compartment shown for gas and oil heat, the other with electric heaters. Photo projector will be installed for illustrating installations throughout the country; represented by George A. Young, R. B. Reed, V. A. Fox, E. P. Meyer, G. G. Parry, T. P. McVicker, A. H. Ackermann and T. Lydon.

Builds Shop Where Roads Converge

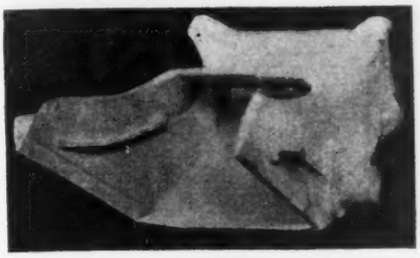


Fig. 1—Locomotive water scoop casting

Farsighted Judgment Years Ago, Saving Factor Under Present Stress—Steel Plant Favors Jar-Ram Molding Machines For Varied Production—Handling Problems Solved

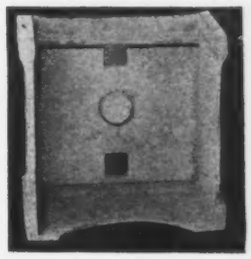


Fig. 2—Driving cellar casting

AFTER the armistice, businees faltered and there was stagnation in the industries of the country. Then the automobile industry, fed by the profits many had made during the war, became active and introduced a wave of prosperity which continued to expand until the foundation of the economic structure began to tremble under the strain. This weakening was seen in growing inability to secure materials of all kinds, and the situation finally became so acute that work on the superstructure of luxuries was curtailed and the country decided it must do what it should have done in the beginning—strengthen the foundation by reinforcing the transportation systems of the country in order that prosperity may go ahead without danger to the economic system.

EVERY industrial establishment has impressed upon it the mark of individuality of some one or more of its executives. Conversely a closer acquaintance is possible when something is known of the life work and accomplishment of a person whom one meets away from his daily environment. The accompanying article presents an exceptional steel foundry which is actively directed by Carlton S. Koch, the president of the American Foundrymen's association. It is offered at this time in the hope that it may make foundrymen better acquainted with the head of their organization.

The foundries of the country were strongly affected by the general transportation situation with its threatened strangling of the inflow of pig iron, coke, sand and other materials, and the difficulty of shipping the products of the shop. It is easy to see that without proper delivery facilities the foundry is badly handicapped. This lesson has emphasized the importance both of railroad transportation into and out of the foundry and also of internal movements of materials and castings in the shop, especially in handling sand.

The value of efficient freight facilities for the foundry has been appreciated by C. S. Koch, president and general manager, and H. J. Koch, secretary and sales manager of the Fort Pitt Steel Casting Co., McKeesport, Pa. Transportation first was considered years ago when the plant was located. Among the several reasons why McKeesport was selected as the home of the company was wide railroad advantages at hand. The Baltimore & Ohio railroad runs along the northern edge of the company's property and is paralleled by an industrial track which extends along the east side of the buildings, as may be noted in Fig. 4. This road affords shipping facilities east and west and connects with the Buffalo, Rochester & Pittsburgh railroad which taps the territory to the north. In addition to the direct contact with the Baltimore & Ohio, the plant is near the Pennsylvania and the Pittsburgh & Lake Erie railroads. Ad-

FIG. 3—SAND IS BROUGHT TO ONE SIDE OF THE MIXER IN DUMP BOXES—AFTER PASSING THROUGH THE MIXER IT FALLS INTO A BOX CARRIED ON A LIFT TRUCK AND IS CONVEYED TO THE MOLDING FLOOR

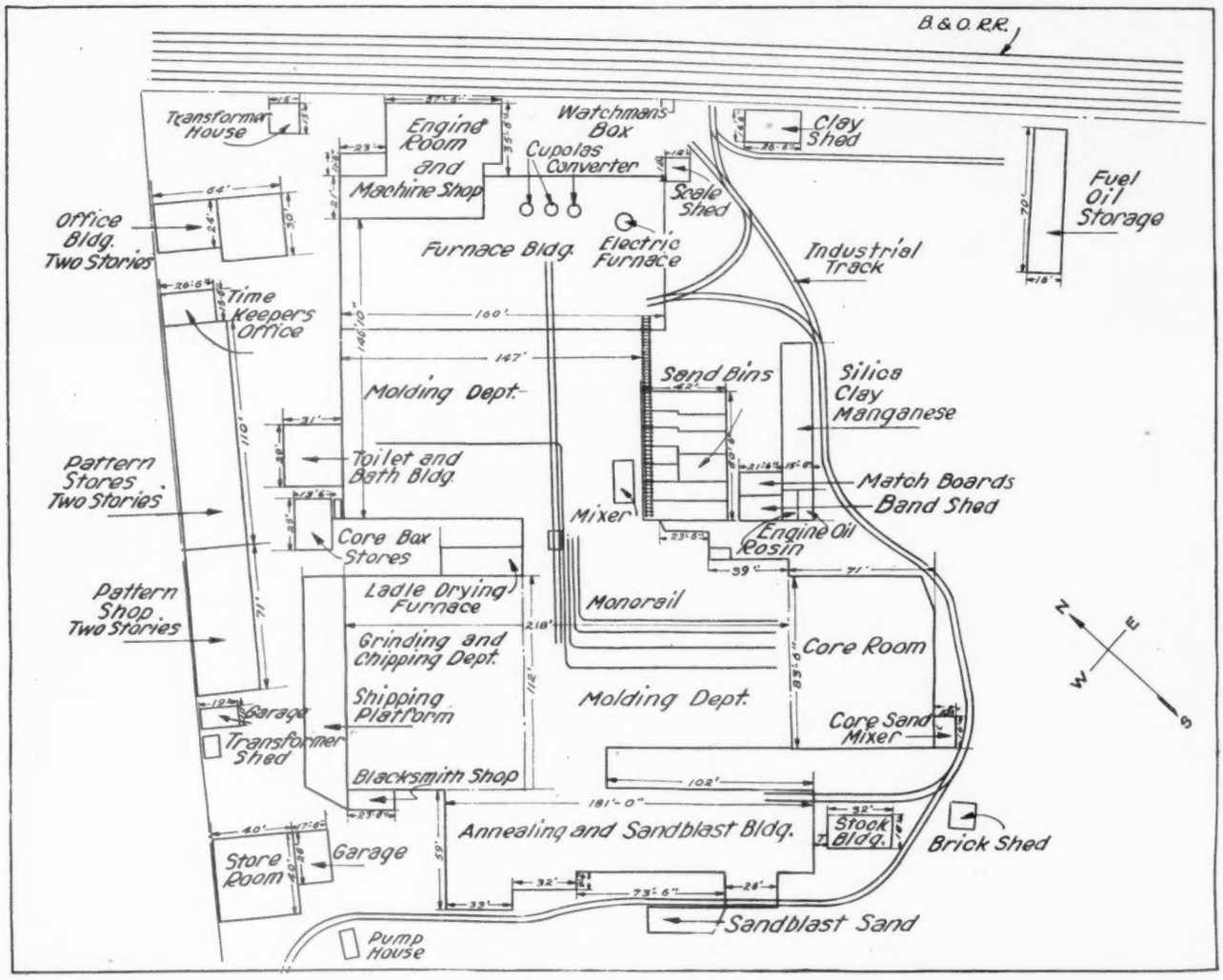


FIG. 4—THE FOUNDRY CONSISTS OF A GROUP OF FIVE PARALLEL BUILDINGS LOCATED BESIDE THE RAILROAD RIGHT-OF-WAY—AN INDUSTRIAL TRACK FROM THE FURNACE ROOM TO THE POURING STATION SERVES TO CONVEY THE MOLTEN METAL TO THE MOLDING DEPARTMENT

vantage is taken of this proximity to truck materials to and from these lines. Through the Pittsburgh & Lake Erie railroad connections, the New York Central system, the Erie railroad, and the Western Maryland railroad are reached. The Pennsylvania railroad, of course, opens up a wide territory both east and west.

To understand the system of transportation and conveyance within and about the plant the location of the buildings should be noted. The general layout is shown in Fig. 4. Here it may be seen that there is a cluster of five distinct buildings around which are scattered a number of smaller buildings such as the pattern shop and storage building, the office building, store room, etc. The five buildings in the main group extend parallel to each other. The annealing and sandblast building is shown in the lower part of the illustration. The building next above it contains the core room, the grinding and chipping department, and a portion of the molding floor. The third houses the remainder of the molding floor together with the sand-storage bins. Above this is the furnace building, and the machine shop and engine room are at the end.

Served by Industrial Track

Pig iron and sand are unloaded along the railroad track which parallels the company's property on the one side. An industrial track serves to convey these materials to the foundry. The sand is taken to the elevated track which runs over the sand bins. The car containing the sand is lifted to this track by an elevator and dumps the sand into separate bins as desired.

Stock for the furnaces is brought to the furnace room on cars. When the metal is melted and ready to pour it is carried to the pouring station between the two molding floors on the track, Fig. 4. It may be noted that the sand mixer is located in front of the sand bins, adjacent to both molding floors. This minimizes the distances by which the sand is carried to and from the molding floors. Both molding floors are conveniently located with respect to the grinding and chipping department. This arrangement of parallel buildings has another advantage besides that of bringing the different departments near to each other, thus minimizing the distances for conveying metal, sand and castings. This other advantage is seen when it is desired to extend any department. If more molding floor space is required it is only necessary to lengthen one of the buildings, and this can be done without disturbing the remainder of the shop.

An illustration of this feature recently was given when it was decided to install an electric furnace. All that was necessary was to lengthen the furnace building 60 feet, and no other part of the shop was discommoded. The furnace room now contains two 2-ton side-blow converters and two cupolas for melting the converter charge. Only one of the cupolas with its converter is operated the same day, and as three

heats can be made in an hour this converter has plenty of capacity for the requirements of the shop which is equipped for making 500 to 600 tons of castings a month. As many as 30 heats have been taken off in a 10-hour day.

Few castings are made which weigh over 25 pounds. The general run of castings is of light weight, intricate design, with extremely thin sections and is ordinarily for electrical machinery, lifting jacks, oil well supplies, motor trucks, rolling mills and for the lighter parts for locomotives, cars and railroad equipment.

Although the converters have given satisfaction and turn out metal which ran into the finest castings and does not crack, even though brackets are not used in many angles where the cooling strains are excessive, the company has decided to install a 3-ton heroult electric furnace. This is regarded as an experiment and only one of the converters will be dismantled. Some new features will be tried on the electric furnace and it is hoped that advantages will be obtained.

Carbon Contents Regular

Metal is taken from the converter at intense heat and with great regularity as to carbon contents. Ferromanganese is added to the bath before it is poured from the converter. Ferrosilicon is added in the ladle. Both of these alloys are used in the solid state. The ferrosilicon is heated somewhat before the molten metal strikes it, by adding it to the ladle as soon as the metal from the previous heat has been poured into the molds. Two ladles are used alternately. This allows the ladle with the ferrosilicon in it to be heated under a gas or oil flame after each second heat. The ladles are 2-ton capacity and the entire converter charge is poured into one ladle which is carried on a buggy having brackets at each end for the trunnions of the ladle to rest upon. The buggy is pushed to the pouring station by a tractor on a track which is shown near the center in Fig. 4.

Fig. 5 shows the ladle at the pouring-off station. When the tap ladle is brought to this place the slag is pulled off. The first metal from the buggy ladle is caught in hand ladles held by the men who pour it. The hand ladle when filled is hung on the hooks suspended from a monorail and this is carried to the molding floors. After some of the metal has been poured from the buggy ladle it no longer is necessary to lift the hand ladle from the monorail carrier, but the carrier can be pushed near enough to the buggy ladle to receive the metal from it.

This monorail extends from in front of the pouring station to both of the molding floors. Seven men pour off; three take the metal to the one molding department and four carry it to the other molding section. When not pouring, these men help to clean floors. Another gang of seven men shake out the castings, while four men are employed to keep the ladles in condition and pour the big ladle. The molders and machine men do nothing but mold. All casting are removed from the foundry at night. In the morning the men who later pour the metal, fill dump skids with about 40 per cent of the sand. These skids are taken to the sand mixer which is located between the molding floors. Here they are dumped until the pile of sand becomes too high, after which the skids are allowed to stand near the mixer until needed. The skids are conveyed by electric lift trucks of which the company uses three. These trucks together with the tractor and a few hand-operated lift trucks, supply practically all the locomotion for materials inside the shop.

Mixer Works Continuously

The sand mixer is operated continually all day. Three men shovel the sand into a bucket which lifts on a bearing and shoots the sand into the mixer. Old sand is mixed with new in the proportion of 45 to 10 or 15 depending on the work for which the sand is to be used. One part by volume of fireclay and the same amount of flour is added to this mixture, together with enough water to give it the proper temper. Sand is dropped directly from the mixer into dump boxes which are carried to the molding floors. This sand is used as facing by the molders.

The mixer may be seen in Fig. 3. To the left a truck is dumping a load of sand and to the right another may be seen placing a box in position to receive a load from the mixer. The hopper for charging the mixer is raised for discharging a load of sand. The same trucks carry refuse sand to the dump on company land.

A different system for handling the sand is being tried by the company. With the new system each molding floor is supplied with three rows of skids. Each skid holds six molds of the average size which is about 14 x 17 inches. The molder fills one row of skids and while he is filling

FIG. 5—METAL IS BROUGHT TO THE POURING STATION IN A LADLE CARRIED ON A BUGGY—FROM HERE IT IS CARRIED TO THE MOLDING FLOORS ON MONORAILS

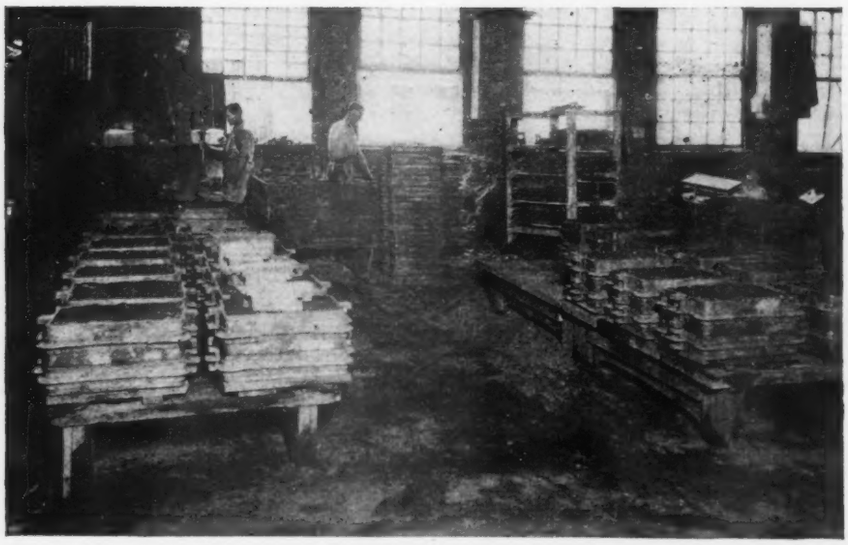


FIG. 6—ONE MOLDER MAKES THE DRAG AND THE OTHER THE COPE—CORES FOR THE DRAG ARE SET ON A RACK NEAR THE MOLDER—MOLDS ARE PLACED ON SKIDS

the next row the molds in the first row of skids are poured and the flasks taken off and piled near the molder's bench. Then when the molder is filling the third row of skids, flasks are taken from the second row, and skids in the first row are carried by the electric lift trucks to a portion of the floor where the sand and castings are dumped. The skids are then taken back to the molding floor and formed into a new line for receiving more molds. When the sand is dumped it is tempered and put through a vibratory riddle placed over a box on a skid. The filled box is carried back to the molding floor and set down in close proximity to the molder.

This process is illustrated in Figs. 6 and 7. Fig. 6 shows two molders working on one mold, the one making the cope and the other the drag. In front of each molder there is a pile of sand and between them there is a box of facing sand. Cores are used only in the drag of this mold. The rack on which the cores are brought from the core room may be seen to the right in front of the molder working on the drag. One line of skids to the left has been filled and the line to the right is nearly full of molds. The line in the center has been taken away to be dumped and will be returned before the second line of skids is filled. In Fig. 7 the line of skids to the left has been poured and two workmen are lifting the flasks from the mold. This is done rapidly by means of two hooks which hang loosely on the bar carried by the two men. The hooks are let down and fall against both sides of the flask engaging the lugs. The workmen then raise the bar with a jerk and the flask comes from the

FIG. 8—CORES ARE SET ON A RACK BEHIND THE COREMAKER—FROM HERE THEY ARE SET INTO DOUBLE-END OVENS LOCATED ON THE OPPOSITE SIDE OF THE RACKS

FIG. 7—WHILE THE MOLDERS ARE FILLING ONE ROW OF SKIDS, FLASKS ARE TAKEN FROM THE NEXT ROW AND THE OTHER ROW IS CARRIED TO THE DUMPING STATION

mold. The flasks have been taken from the row of skids to the right and piled near the molder, and the electric truck is ready to lift the first skid and carry it to the dumping floor. This method of handling the sand has proved so beneficial in the short time it has been tried that the company contemplates adopting the system throughout the entire shop.

For a number of years a study has been made to determine the method of molding best suited to the demands of the shop, and it was finally decided that it would be advantageous to adopt the plain jar-ram molding machine for all machine work. The major advantage of this method which appealed to the company is the ease with which the machine may be changed from one patern to another. This is important to the Fort Pitt company because many of their customers

have short run orders which they end with their repetition work. Again, the company receives orders for a large number of castings which call for only a few a day. In such cases, with the jar-ram method it is no trouble to change from one pattern to another. An illustration of a job being worked under these conditions is that of a water scoop for a locomotive, Fig. 1. A large number of these castings are on order, but delivery of only four a day is required. For this reason, in order not to stock them, not more than four are made each day.

Jobs Easily Changed

In making these water scoops the pattern and flask are clamped to the machine and four drags are rammed. The lower portion of the core is made of dry sand, but the larger portion is made on the same machine as the mold. The core box is placed on the machine and jolted. Then the dry core is placed on top of the green sand section. This is covered with a form, as illustrated in Fig. 9. After the form and the core box are hooked together they are rolled over and the core box is lifted off. Then the core is raised by three hooks attached to a Y-shaped carrier as shown in Fig. 10, and lowered into position in the drag. The molds are finished by attaching the cope pattern and flask to the jarring machine and jarring four copes. Although the casting as shown in Fig. 1, has very thin walls to which are attached heavy lugs, no particular difficulty has been experienced in making them free from all shrinkage spots without use of chillers.

FIG. 9—A GREEN-SAND CORE IS JARRED ON A MACHINE AND A DRY-SAND SECTION IS LAID ON TOP—AFTER A FORM IS PLACED OVER THE WHOLE CORE, IT IS TURNED OVER

One of the most complicated and delicate castings which the company has to make is the wheel for an electric baggage truck with the blank gear cast inside. The casting with portions of the mold and cores is illustrated in Fig. 12. The mold is rammed on a jar-ram machine and a boy makes the body cores in the box shown to the front. This box is jarred and the end, sides and one top piece, shown at *A*, are removed. The core is lifted by a hook which screws into the arbor. Eight of these cores are required. Two of them may be seen in position in the drag. Two other cores are used to make the mold. The one is in sections and forms the upper portion of the rim of the wheel. This may be seen at *B*. The other dry-sand core is in a center core forming the hub. The casting is poured from two horn gates cut in diagonally opposite corners of the mold. No brackets are used.

FIG. 10—THE DRY-SAND PART OF THE CORE SUPPORTS IT AS IT IS SET INTO THE MOLD

One feature about the casting methods used by the Fort Pitt company is that few if any brackets are used. Even the driving cellar castings shown in Fig. 2 or the baggage truck wheel casting, just described have no brackets, although they are thin sectioned castings with sharp angles.

Company Trains Its Molders

The success of this company in handling difficult castings in a great measure is due to the high grade men employed. Practically all the molders employed, in fact all but two, have received their training in the company's own foundry.

It is possible for the company to train its own molders because the largest percentage of the molds are made on jar-ram machines of which 46 are installed, ranging in size from those with a 24 x 30-inch plate to the larger ones with a 3 x 4-foot plate. Practically no skill is required in ramming molds on this type machine, but considerable experience is necesary before the new operator becomes efficient in drawing the patterns. What little work is done by hand molding is segregated in two

FIG. 11—PASTE IS APPLIED TO THE CORE BY PRESSING THE CORE ON A PERFORATED FLOAT SUPPORTED IN THE PASTE

the core room. When the coremaker finishes a plate of cores he places the plate on a rack behind him. This may be seen in Fig. 8. The cores are put into four double-end ovens from these racks. As may be noted in Fig. 8, the ovens are directly in front of the racks. Drying stands on the opposite side of the ovens receive the cores as they are taken out. The cores are carried on the racks or on wood cradles to a bench where they are pasted. An ingenious scheme has been devised for pasting the cores. A liquid paste made of glutrin thickened with flour is mixed in a box. Then a wood float, as illustrated in Fig. 11, is laid on the liquid paste. This float has perforations and, when the core is pressed gently on the float, paste comes through the holes in the float and sticks to the core as may be noted. Each different style core has a special float. After the cores are pasted they again are placed in drying ovens for an hour.

seperate portions of the shop. In the one the bench work is assigned and the other is devoted to floor work. However, a total of only 10 per cent of the molding area is given to hand molding. A committee decides where all molds should be gated and gate and riser sticks are supplied to the molder with the pattern so that nothing is left for him to determine.

Another feature about the molding practice is that all molds are made in green sand. The company has found that it can make its own flasks which will weigh little more than flasks made from rolled stock. These cast-steel flasks have ⅜-inch sides and are extremely long-lived, some of them having been in use for 15 years.

The core room is equipped with two jar-ram machines and seven roll-over machines. A row of roll-over machines is located along one wall of

FIG. 13—TWO COREMAKERS WORK ON ONE JAR-RAM MACHINE—THE ONE JARS THE CORE AND THE OTHER FINISHES IT—TWO OR THREE BOXES ARE USED

FIG. 12—THE GEAR WHEEL FOR AN ELECTRIC TRUCK IS MADE WITH GREEN-SAND BODY CORES

Certain classes of cores are better adapted to the jar-ram mchine than to the roll-over machine and special arrangements have been made for the operation of these machines. Fig. 13 illustrates the method of operation on one of the jar-ram machines. The operator on the far side of the table fills the box with sand after placing any stiffening wires which are necessary. Then after jarring the box he pushes it across the table to the second operator who puts on a plate, turns the core box, and withdraws the box leaving the core on the plate. The plate is then set on a rack standing near. When the rack is full, it is placed in the drying oven with a lift truck. This oven may be seen to the left in Fig. 13, with a rack of cores

in front of it. Besides this rack oven there are four other similar ovens, the four ovens previously mentioned, and one cabinet revolving table oven in the core department. These ovens are all arranged to burn either oil, gas or coke. The flexibility of the jar method for making cores is shown in this illustration where the core-maker has just passed a shallow box across the table and is starting to ram a deep box. With this machine a different core could be made every time, but the usual custom is to run two or three different boxes in turn until the required number of cores are made from any one box when a different box is substituted.

The core room, as may be noted in Fig. 4, is located at one end of one of the molding bays. Cores are taken from here to the molding floors on racks either by electric or by hand-lift trucks. This is easily done as a system of concrete aisles have been laid all through the buildings. The proximity of the molding floors to the finishing department affords ready access to the grinders of which there are 12 of the swinging type and 8 double stands. All of these are direct connected to individual motors. The finishing room also contains a full complement of sandblast equipment. There are two revolving table rooms 8 x 8 x 8 feet together with one cabinet of the revolving type and two 40 x 50 sandblast tumbling barrels. One of the latter is rigged so that it will automatically drop its load of castings into a truck placed beneath it.

Provision is made for welding castings when necessary either by electric or oxyacetylene welders. The electric welder is employed where there is much metal to be built up and the gas welder is used for deep thin holes.

FIG. 15—TWO CARS ARE USED WITH THE ANNEALING OVEN—WHILE ONE CAR IS IN THE OVEN, CASTINGS ARE UNLOADED AND LOADED ON THE OTHER CAR

The castings to be welded are placed on one side of a table which revolves on roller bearings and has a sheet iron shield across the center of it. The table is then turned 180 degrees and the shield protects the workman who is placing the castings on the table while the welder is working on the other side. Welded castings are always annealed after welding.

The greater percentage of castings are annealed in a car type furnace shown in Fig. 15. This furnace is coal-fired through two doors on the side opposite to the one shown in the illustration. Four thermo-couples are used to determine the temperature of the oven. Two of them are placed near each end at the top and two extend through the side opposite the firing doors. These are attached to a recording instrument. A selective switch also connects any one to an indicating instrument. Castings are piled carefully on one of the two cars. When it is desired to place the castings in the oven the doors are opened and the two cars are moved, the one out of the oven and the other into the oven by a continuous wire rope operated by an electric winch. The furnace holds approximately 4½ tons and the castings are heated 5 hours on the average. After that they are left to cool in the oven from 8 to 12 hours.

In addition to the car-type oven two muffle ovens are employed. These ovens were used for all annealing, but since the car-type oven has been installed, they are used only for annealing the most intricate castings which require special care in packing. The main advantage in the car-type oven is that it is easier to load and unload, and that it can be operated almost continually.

One of the difficulties which so frequently exists in the cleaning departments of steel foundries is to handle the work systematically and in the order in which it was produced in the casting department. The Fort Pitt company has to a great extent overcome this difficulty by an arrangement of skids, handled by electric lift trucks. Reference to Fig. 14 will show the general use of these skids as applied to the grinding department. A skid full of castings to be ground is placed behind a grinding machine, and an empty skid is stood aside of it. The workman takes the casting from one skid, and after it is ground, places it on the other. The same system is applied in every other operation in the finishing department. By this method, no castings are placed on the floor at any stage of the operation.

FIG. 14—CASTINGS ARE BROUGHT TO THE GRINDERS ON SKIDS BY AN ELECTRIC LIFT TRUCK—SOME SKIDS HAVE WOOD RUNNERS WHILE OTHERS HAVE RUNNERS MADE OF CAST STEEL

Resume Operations in Indiana Foundry

Operation of the Huntington Steel Foundry Co., Huntington, Ind., will be resumed immediately by a new and refinanced company which has acquired the property. William H. Armstrong, mayor of Racine, Wis., who is president of the reorganized company, has had a wide manufacturing experience. For seven years he was secretary and treasurer of the Mitchell Motors Co., and now is president of the Armstrong Foundry Co.; president of the Splitex Radiator Co., and vice president of the American National bank, all of Racine. E. T. Pelton of Chicago, the new vice president of the Huntington Steel Foundry Co., has had over 20 years in steel casting manufacture. He was associated with the National Steel Foundries, Milwaukee, for a number of years, and was then general manager of the Pelton Steel Co., that city, which company still bears his name. Recently, however, he has been identified as consulting engineer with Frank D. Chase, Inc., Chicago. N. I. Silver, Racine, is secretary and Leo Cohen, Chicago, is treasurer. The new company will specialize on electric steel castings, operating a jobbing plant and will discontinue the production of gray iron castings.

Withdraws from Castings Company

The American Metallurgical Corp., Philadelphia, announces that its holdings in the Philadelphia Electric Steel Castings Co., Philadelphia, have been sold to the recent purchaser of that company, and the Metallurgical corporation has withdrawn from the company, both in connection with the finance and as to service of its officials.

West Point Foundry Elects Officers

At a recent meeting of the stockholders of the West Point Foundry Co., West Point, Montgomery county, Pa., the following officers were elected: President and secretary, Herbert L. James, vice president, Llewellyn M. James; treasurer and manager, Samuel B. Strauss. These men have had many years of practical shop and foundry experience. Herbert L. James was connected with the Crane Iron Works, Catasauqua, Pa., for fourteen years manufacturing gray iron basic and low phosphorus pig iron. For the past 15 years he has been managing machine shops and foundries making light and heavy castings in green sand, dry sand and loam. Llewellyn M. James also has had an extensive experience in the same line. During the war he served as superintendent of production on marine engines for the United States shipping board. Samuel B. Strauss has had 20 years' experience as molder and superintendent of foundries in the vicinity of Norristown, Pa.

The main foundry building measures 40 x 150 feet, or 6000 square feet of molding space. The cupola capacity is 30 tons a day. The cleaning room and core ovens are almost finished and it is expected that production will commerce shortly. The company claims to have contracts and work in sight for the next three years.

Forehearths Not Often Installed

By H. E. Diller

Question: We should like to know if many foundries use forehearths on their cupolas and what are the advantages of such hearths.

Answer: Few foundries in this country use forehearths with their cupolas, but it was almost the universal custom in Europe to use them. In more recent years many of the new installations in Europe do not include them. The advantages claimed for forehearths are the retention of heat in the metal longer than if the metal is held in the cupola or in a mixing ladle. It also is claimed that less sulphur is taken up by the iron when the forehearth is used. The forehearth is simply a covered vessel for holding the iron with a hole for tapping the metal and another for tapping the slag. It is directly connected to the cupola so that the metal may run into it as soon as it is melted. When the metal is in the forehearth it is not subjected to the action of the cold air from the blast which would strike it were the metal held in the cupola; neither does it lay against the coke bed, and so it may absorb less sulphur. Just how much advantage is gained in these respects has never been measured. On the other hand, the expense of keeping up the lining of the forehearth is a detriment, and it is not as flexible as a ladle which may be removed easily when desired.

Establish Alloy Foundry

An aluminum and brass foundry has just been established at 2157 Blue Island avenue, Chicago, under the name the National Aluminum & Brass Foundry, by Victor S. Kucki and Frank T. Luka. Jobbing work in nonferrous alloys will be produced.

Water Causes Explosion

In a recent accident the top of a steel furnace was blown off when a charging box of scrap, containing some water, was dumped into the furnace. This charging box was loaded out of doors and a considerable amount of snow had collected on the scrap. When brought in doors the snow melted and the water collected in the bottom of the box. It is of course evident that had drain holes been provided in the bottom of this box, it would have held no water and the explosion would not have occurred.

Selling Agency Secured

The B. & B. Mfg. Co., Indianapolis, manufacturer of molding machines has entered into an arrangement with the American Molding Machine Co., whereby the latter company attends to the selling end of the business. The two companies continue as before entirely independent entities each operating its own manufacturing plant; but with the American Molding Machine Co., attending to all the sales.

All Ready for Columbus Convention

(*Concluded from page* 716)

Co. also has a foundry in Columbus.

An interesting and rather unusual foundry is that operated by M. C. Lilley & Co., which manufactures lodge and society regalia. This firm produces its own small nonferrous castings which enter into the ornamentation of its uniforms. In addition to this foundry, several brass shops supplying machinery castings and plumbers goods are in operation. These include the Atlas Brass Foundry, the Columbus Brass Co., the Buckeye Pump & Mfg. Co., the Ohio Pump & Brass Co. and the Hocking Valley Railway Co. foundry. The Seagrave Co., builder of fire apparatus, has a brass foundry of its own.

Ohio State university maintains an interesting shop where its engineering students are instructed in elementary foundry practice in connection with their course in shop practice. Patternmaking, similarly is taught in the woodworking shops of the university.

The name of the Detroit Valve & Fittings and Detroit Brass Works, Detroit, Mich., has been changed to the Detroit Brass & Malleable Works. This represents a consolidation of two well-known interests which retained a combined name until the present time.

English Foundry Makes Rail Chairs

Quantity Production Methods Are Employed in This British Shop—Molds Are Made on Roll-Over, Stripping-Plate Machines of Special Design — Cupolas Melt Continuously

BY H. COLE ESTEP

RAIL chairs are virtually unknown in the United States. In Great Britain, however, they are required in such large quantities that a number of gray-iron foundries have been designed and built to deal almost exclusively with this specialized commodity. These shops are equipped with all of the facilities usually found in modern manufacturing foundries. Molding machines, mechanical sand-handling apparatus, mold conveyers, pouring devices, etc., are extensively employed. The rail chairs and kindred products are turned out on a quantity basis under conditions calculated to produce the greatest tonnage at the lowest possible cost. The equipment used and problems encountered, therefore, possess many features worthy of study by American and other foundrymen interested in mass production, even though they may not make exactly the same sort of castings. Among the several producers of rail chairs in the United Kingdom, one of the most prominent and largest is Smith-Patterson & Co., Ltd., Blaydon-on-Tyne, near Newcastle, England. Under the direction of R. O. Patterson, works manager, this company recently has placed in operation a new rail-chair foundry embodying a number of unusual and interesting features which it is the purpose of this article to describe. But before taking up the details of the new Smith-Patterson foundry, it is perhaps advisable to present a few facts regarding the rail-chair industry in Great Britain as a whole inasmuch as it has no counterpart in the United States.

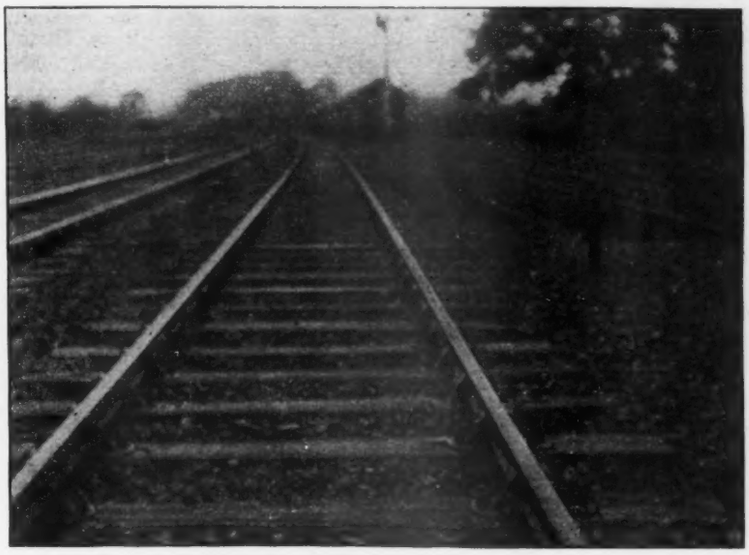


FIG. 1—THE "CHAIRED METALS" OF KIPLING—SECTION OF A BRITISH RAILWAY LINE SHOWING HOW RAIL CHAIRS ARE USED

The rail-chair business has grown up as a result of a fundamental difference in the construction of railroad

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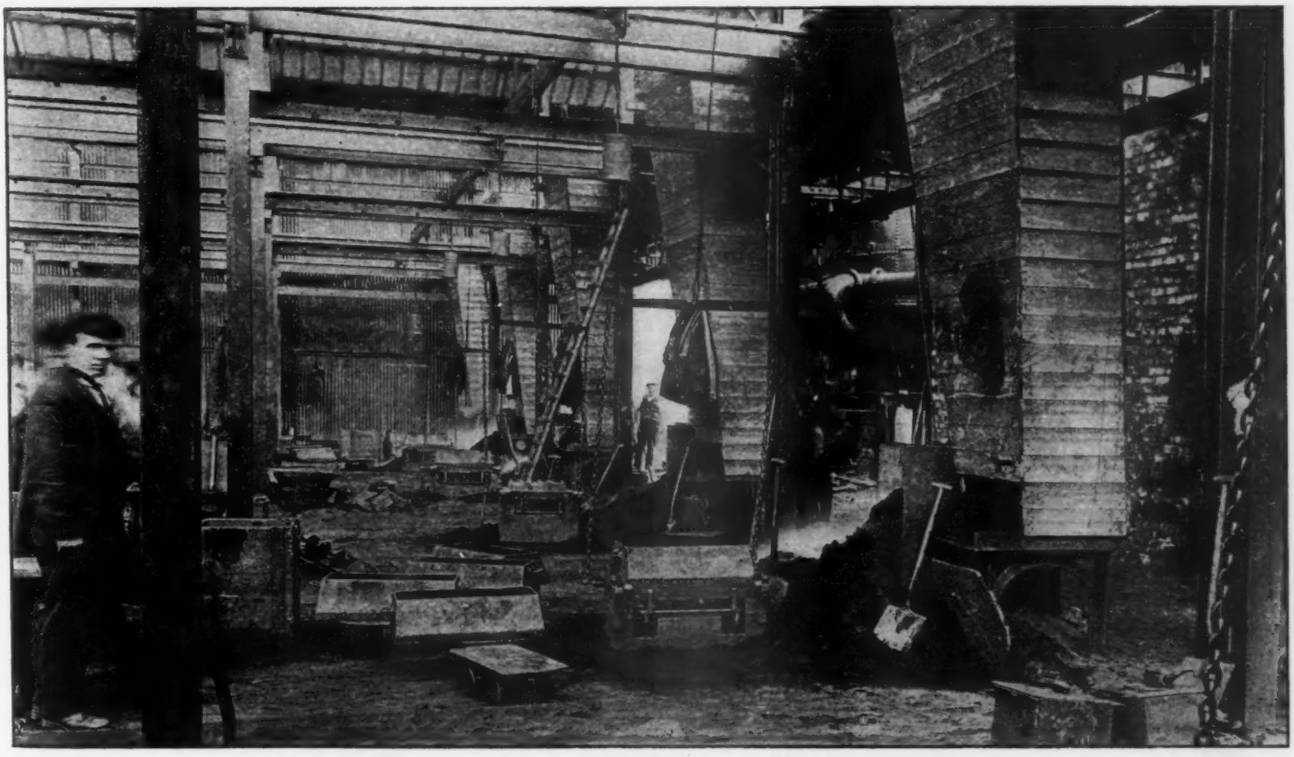

FIG. 2—GENERAL VIEW ACROSS ONE END OF RAIL-CHAIR FOUNDRY SHOWING FACING-SAND CHUTES AND MOLDING MACHINES

FIG. 3—ONE OF THE GANGWAYS SHOWING TRAIN OF MOLDS READY FOR POURING, WITH SAND CHUTE AND MOLDERS' STATION IN BACKGROUND

tracks in the United States and the British Isles. American railroads use flat-bottom rails which are spiked directly to the ties, or sleepers, as they are called abroad. British and most European railroads use bull-headed or double-headed rails which rest on specially designed cast-iron chairs that are in turn spiked to the ties. The bottom of the rail is raised about 1½ inches above the tie. A section of a British railway line showing how the rail chairs are used is shown in Fig. 1. A plan and elevation of a 50-pound chair showing the rail and wooden wedge in place are presented in Fig. 7. This form of track construction of course is considerably more expensive than that employed in the United States, but it is said to have the threefold advantage of holding the track securely to gage, protecting the ties from wear, and making it possible to use a less number of ties. On most English railways the ties are spaced on 31-inch centers. Some idea of the size and importance of the British rail-chair industry may be gathered from the fact that since, according to the latest figures, there are 55,261 miles of track in Great Britain, there must be about 226,000,000 rail chairs in use. They have a limited life, about 20 years, and, therefore, the replacement demand alone is heavy and continuous.

The chairs are made of a good grade of gray iron. They are of various weights to fit the different weights of rail. Most of those now being made weigh about 50 pounds each. They are about 1 foot 3 inches long and 7½ inches wide on the base, which is 1⅜ inches thick. They usually are provided with four spike holes which taper from 1¼ inches in diameter at the top to 1 5/32 inches at the bottom. As will be described in detail later, these holes are made with green-sand cores. As shown in Fig. 7, the lip against which the rail sets has a back draft, which makes it necessary to provide the pattern with a loose piece. Another loose piece is necessary to form the horn lip which holds the wooden wedge in place. The molds are made on roll-over pattern-drawing machines, and as Fig. 3 and subsequent illustrations indicate, the job is not quite so simple as first appearances might indicate. The castings must have a good finish, be sound and strong, and meet certain tests prescribed by the railway companies.

Smith-Patterson & Co. also make brake shoes in their rail-chair foundry. The brake-shoe castings weigh from 21 to 56 pounds each and are molded three in a flask, using the same general equipment and method as that employed for rail chairs. Of course in the case of brake shoes, provision must be made for setting the dry-sand cores. In addition to the foregoing, special rail-chairs are made for switches and turnouts, together with car journal-boxes, buffers, permanent way, and miscellaneous railway castings. In their jobbing foundries, Smith-Patterson & Co. also make turbine casings and a large number of other gray-iron castings of various sorts. The firm employs 400 men and has a capacity of about 750 tons of castings a week. The business was established in 1865. The plant was moved to its present location in 1872; about 10 acres of ground are occupied at present. But it is mainly with rail-chair production that this article is concerned.

The new rail-chair foundry employs about 50 men. It is housed in a specially designed building, 117 feet long and 102 feet wide. A general plan and elevation of this structure is shown

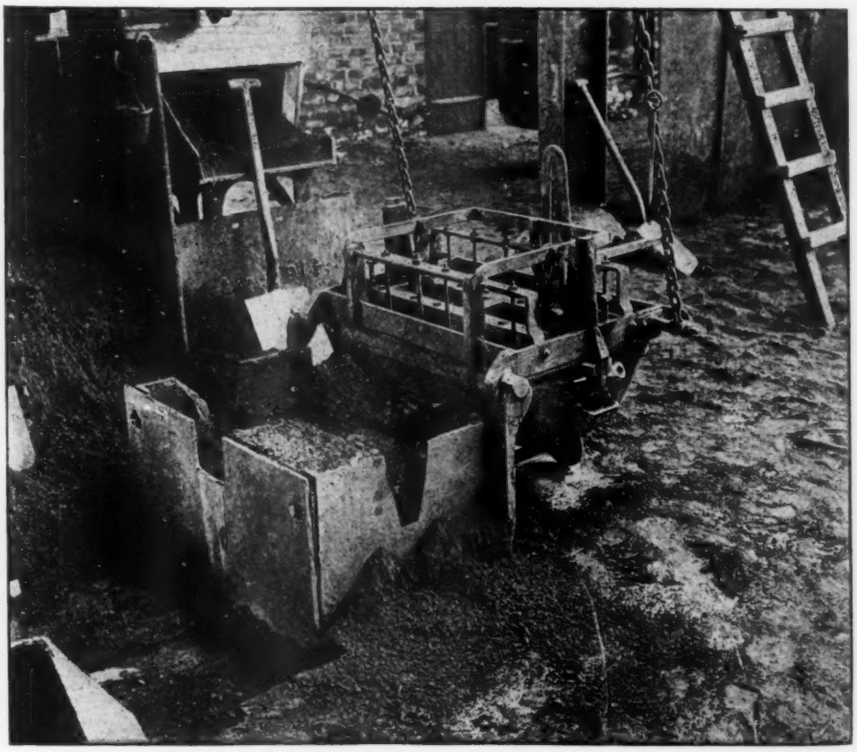

FIG. 4—ONE OF THE MOLDING MACHINES WITH FLASK ROLLED OVER READY TO DRAW PATTERN

in Fig. 9. As this illustration indicates, the molding room, which is surmounted by a saw-tooth roof, is divided into six longitudinal bays each 17 feet wide and 92 feet long. A cross bay 25 feet wide adjoins one side of the molding floor and covers the ends of the longitudinal bays. This cross-bay is provided with a 3-ton traveling crane which runs out into the yard to facilitate the delivery of finished castings. The building is a steel-frame structure, the eaves being 20½ feet from the ground over the molding floor. The eaves over the cross bay at the end of the shop are 29½ feet from the ground. A cement tile roof is provided, and the saw-tooth construction gives ample light, without shadows, throughout the foundry.

Charging Floor in the Open

The cupola furnaces, two in number, are placed at one end of the molding room, just outside the building, as shown in Fig. 9. According to the English custom, and owing to the mild climate, the cupolas and charging floor are practically in the open air. A leanto at one side of the main building houses the small-core room and sand-mixing room. The former is equipped with three core ovens for baking the small brake-shoe cores.

Each of the 17-foot bays in the molding room is served by an overhead trolley rail, which connects with a cross trolley extending the full width of the shop in front of the cupolas. The layout of the trolley tracks is clearly shown in Fig. 9. This arrangement is used for distributing the hot metal to the various floors.

The plant is operated on the continuous melting system. In general, the method of operation is similar to that of American foundries of the continuous type. The work of preparing the sand, molding, melting, pouring, shaking out and cleaning is performed by separate gangs of men who confine themselves strictly to their own tasks. The molders work continuously throughout the day, and the operations of casting, shaking out, cleaning, etc., proceed simultaneously.

To accomplish this, each of the six bays into which the foundry is divided is operated as a unit. The rail chairs and brake shoes are molded in simple two-part flasks each containing three castings. The drags are molded on the machines previously mentioned, each of the six bays being equipped with a machine. For the copes, simple ramming stands are located near the molding machines, at the end of each floor nearest the cupolas. Each molding floor is supplied with facing sand by a hopper filled from overhead. Hot sand returned from the shake-out floors is used for back filling the molds. In addition, a small quantity of specially milled sand is provided for ramming around the rail seats and gullets, at the points marked *B* in Fig. 7.

Mechanical Handling Methods

It is inconsistent with the conditions of continuous operation to set the molds out on the floor and pour them all at the end of the day in the ordinary manner. Some mechanical method of handling them must be provided to keep the molding, pouring and shake-out gangs constantly employed, thus securing a maximum of tonnage from a minimum of floor space and men. This principle —the mechanical handling of the molds —forms the heart of any continuous foundry system. At the Smith-Patterson foundry, unique means, embodying interesting features, are employed for performing this essential part in operating a shop under the continuous system.

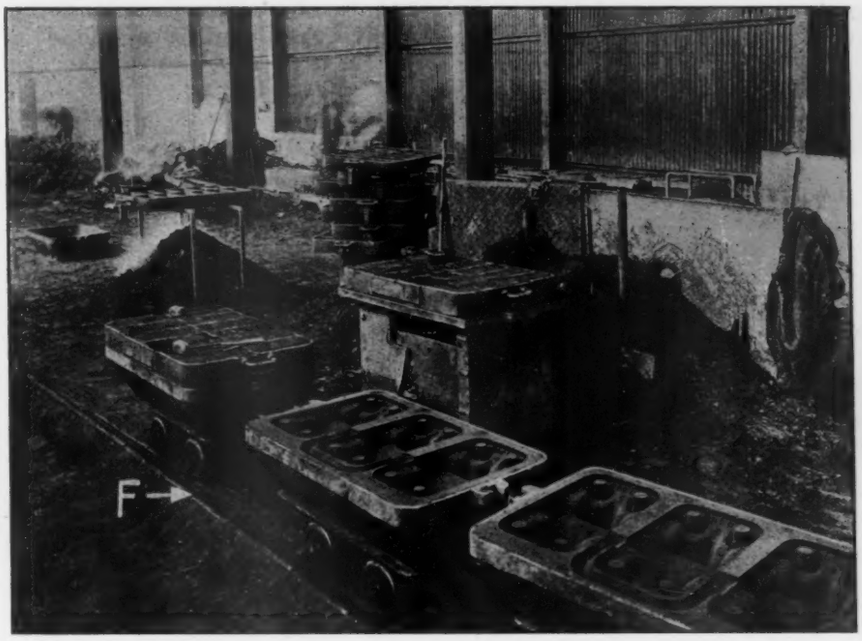

FIG. 6—AFTER THE DRAGS ARE MADE THE MOLDS ARE ADVANCED TO THE COPE STATION WHERE THE FINAL OPERATIONS BEFORE POURING ARE PERFORMED

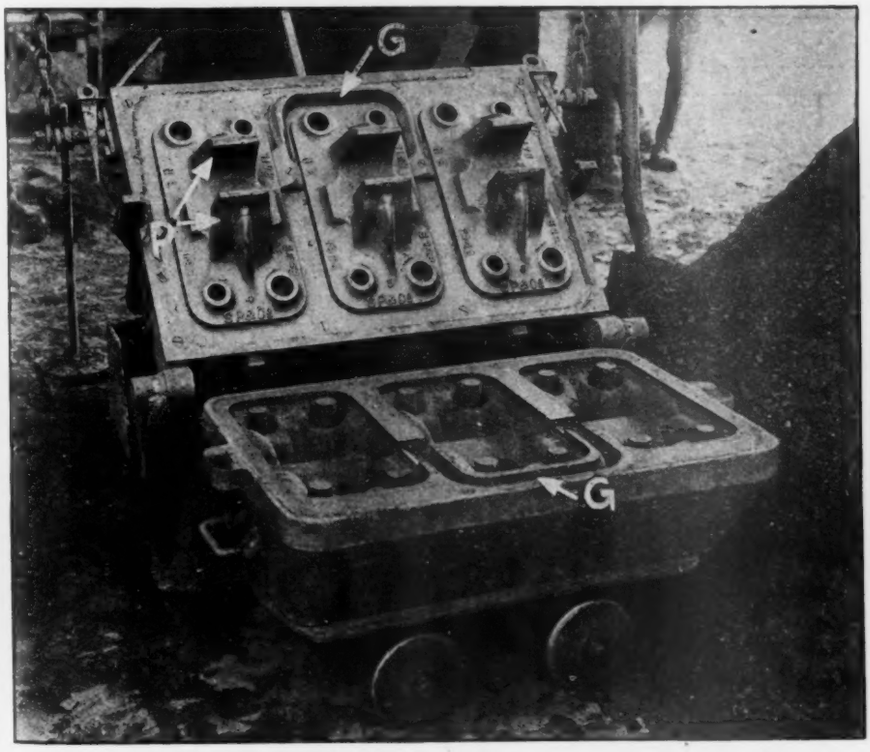

FIG. 5—FRONT VIEW OF MOLDING MACHINE SHOWING PATTERN PLATE AND MOLD TRACK

As the molds are made one by one they are placed on small low four-wheel platform trucks. The drag-molds are rolled over directly onto these trucks by the molding machines. These machines are located, as previously mentioned, at the extreme end of the molding bay, alongside the facing-sand chutes, as shown in Figs. 2 and 9. The mold-trucks travel straight down the floor to the other end of the bay, passing the cope and pouring stations enroute, and terminating at the shake-out station which is located in the cross-bay under the traveling crane. The mold-trucks usually are handled in groups of eight, this being the number cast from a single ladleful of iron. The trucks do not run on tracks but on the floor, each bay being provided with a paved gangway. The trucks are light and are hauled around entirely by hand. To guide the trains in a straight line, one side of each gangway is guarded by a guard rail set on edge in the floor as shown at *F* in Figs. 3 and 6. This acts as a flange or rail against which the mold-trucks are lined-up for pouring. The hot metal is brought to each floor at appropriate intervals in trolley ladles running on the monorail system.

The entire operation is shown clearly in Fig. 3, in which a train of molds may be seen ready for casting, the pouring ladle being in position in front of the first truck. In the middle distance, to the right of the man sitting on the sand heap, is the station where the copes are rammed and set in position on the drags as the trucks go past. This operation is shown more in detail in Fig. 6. Further in the background of Fig. 3, at *C*, may be seen the facing sand chute and drag molding machine. Back of the sand chute, the outlines of one of the cupolas is visible. A detail view of the drag-molding station, from which the mold trucks start on their journey, is presented in Fig. 11. Fig. 2 is a view across the shop showing the six molding stations and facing-sand hoppers in their respective parallel bays.

As previously suggested each unit is operated on the straight-line principle. After the molds are poured, as shown in Fig. 3, the copes are removed, while the castings are still red hot, and returned by hand to the cope-ramming station where the sand is shaken out. The mold-trucks then are hauled onto the end of the floor where the castings are removed for cleaning under the traveling crane. After the castings are shaken out, the trucks, with the drag flasks and spent sand, are hauled back to the molding machine. Here the sand is shaken out of the drags, and the trucks and flasks are then ready to start out on a new journey to the delivery end of the floor.

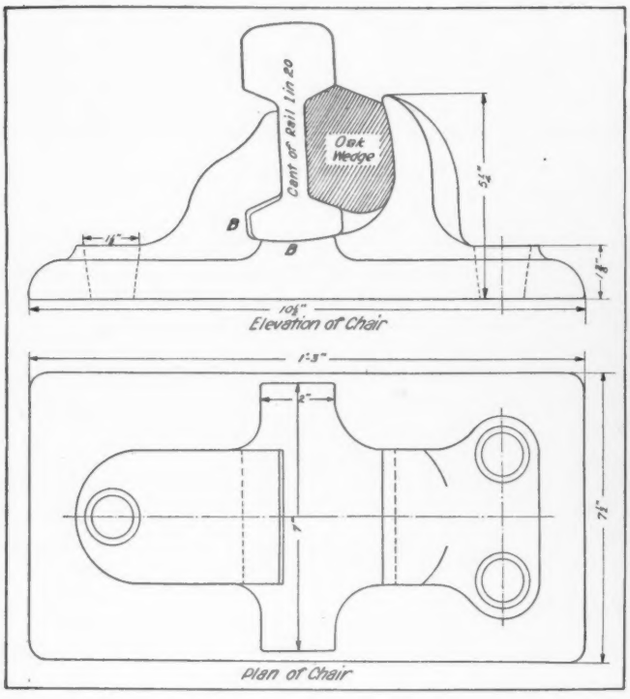

FIG. 7—PLAN AND ELEVATION OF A TYPICAL ENGLISH CHAIR RAIL

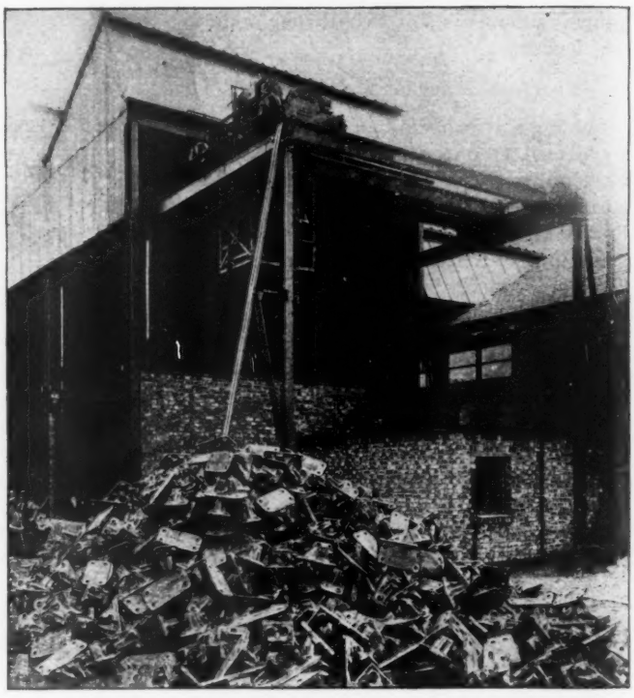

FIG. 8—THE DELIVERY CRANE RUNS OUT INTO THE YARD FOR CONVENIENCE IN HANDLING AND SHIPPING CASTINGS

How the Sand is Prepared

From some standpoints, the sand-handling problem is one of the most difficult to solve in continuous foundry operation. If the whole body of sand is handled and constantly retreated, not only must apparatus be provided for dealing with a large tonnage per hour, but experience has demonstrated that sufficient sand and storage facilities must be provided so the spent sand has time to cool and season before it is used again. If the sand arrives at the molder's station warm and "green," trouble usually ensues, and for this reason efforts to save cost in sand-handling systems through cutting down storage space and reducing the volume of sand to be dealt with generally have proved abortive. Some of the most successful American systems are those which have been so designed that the same sand is not used more than once a day. This is necessary because in practically all continuous foundries in the United States, for the sake of simplicity, only one kind of sand is used throughout the plant. The whole body of sand is treated and tempered as a unit; it may be said, therefore, that all of it is of facing-sand quality. The sand in each flask is uniform throughout.

At the Smith-Patterson rail-chair foundry, a successful compromise solution has been arrived at by using three kinds of sand, as previously mentioned. The cost of the sand-handling plant is thus greatly reduced, since provision has to be made for handling and treating mechanically only a small proportion of the total volume of sand used every day. In fact the sand-handling plant deals only with the facing sand. In addition, a small quantity of sand is given a double milling, and used to form the rail seats and gullets of the chairs, as has been described. For back-filling, that is for 90 per cent of the sand in each flask, black hot sand is used

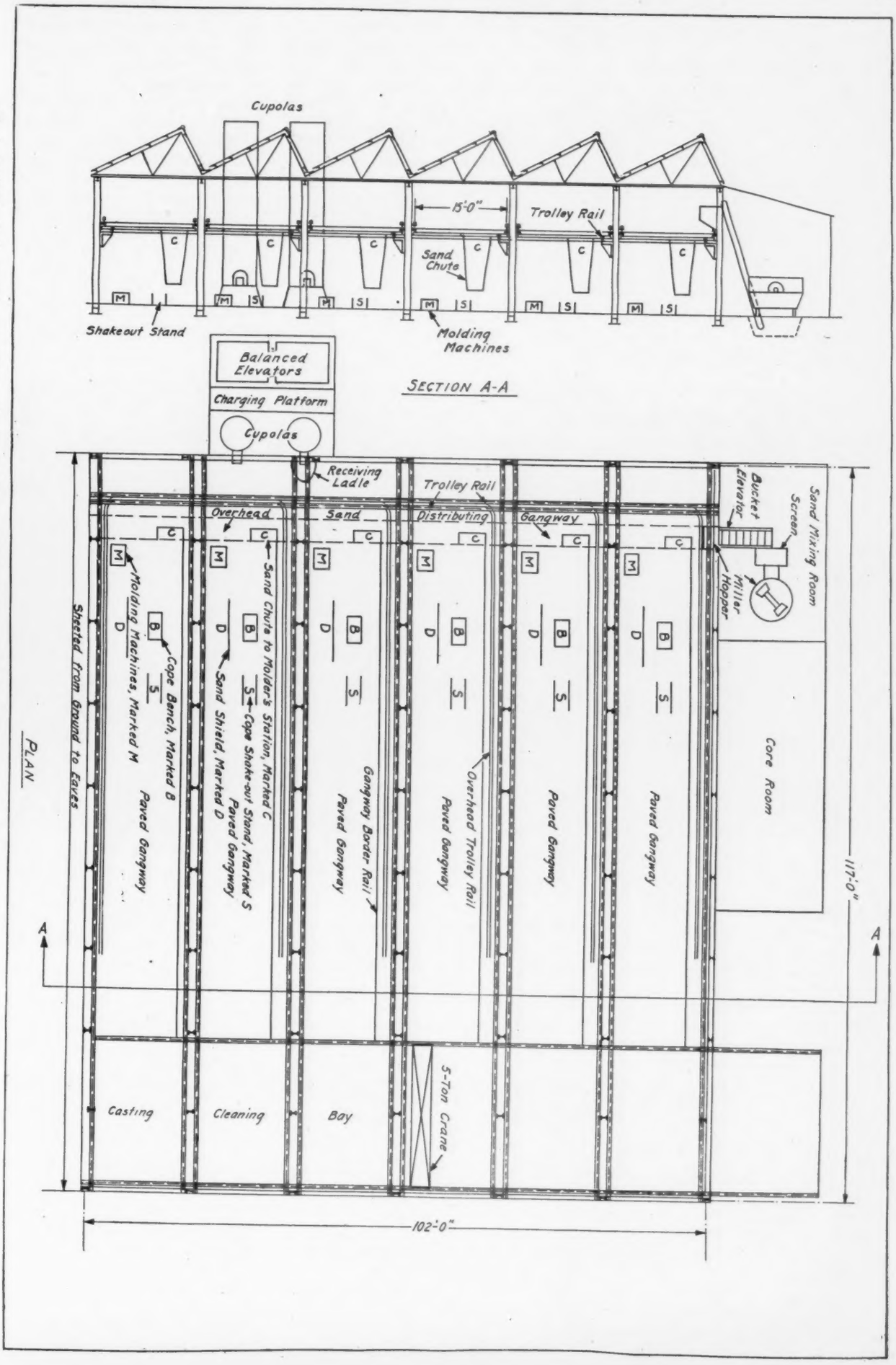

FIG. 9—GENERAL PLAN OF NEW RAIL-CHAIR AND BRAKE-SHOE FOUNDRY NEAR NEWCASTLE, ENGLAND— NOTE ARRANGEMENT OF FLOORS, MONORAIL AND SAND-HANDLING APPARATUS

over and over again with perfectly satisfactory results to the Smith-Patterson organization.

The sand preparing plant is shown in Fig. 10. It consists simply of a pan muller of the usual type in which the sand is milled, a mechanically operated oscillating shaker, and a bucket elevator in which the prepared facing is hoisted to the distributing gallery which runs across the shop as shown in Fig. 2. The sand is shoveled from the muller into the sifter, from which it drops by gravity into the boot of the bucket elevator. At one end of the distributing gallery is a hopper into which the bucket elevator discharges. From this hopper, the sand is let out by an attendant into a light buggy which is utilized to keep the molders' hoppers filled. The latter extend from the distributing gallery to the floor, and are about 12 feet in height with a 24-inch cross-section at the bottom and a 24 x 38-inch section at the top. These hoppers are made of wood, with cast-iron bottoms set on cast legs. Each molding bay is provided with a facing-sand hopper as previously explained, and as shown in Figs. 2 and 9. The small quantities of extra-milled sand used for facing the rail-seats and gullets are handled in barrows.

The ordinary facing sand consists of a mixture of about 10 per cent new sand and 90 per cent old sand, with appropriate quantities of ground sea coal. Neither clay nor sharp sand need be added, since the new sand used has the proper characteristics and binding qualities. It comes from the Thames river, near London, and is known as "Erith Loam." This is one of the most celebrated foundry sands in Europe. For the extra-milled rail-seat facing about a quarter of new sand is employed.

The machines on which the drags are molded are of a special design invented and developed by the executives of Smith-Patterson & Co. They are of the roll-over, stripping-plate type. Metal patterns, which are very carefully and accurately made, are employed. The molds are rammed by hand and rolled-over in the same manner. But for the roll-over operation a balance-weight is provided. The general arrangement of the molding machine is shown in Figs. 4 and 5; the latter also shows the construction of the mold-truck clearly. It consists simply of a steel plate platform mounted on four 6-inch wheels which are held onto fixed axles by cotter pins. Twenty sets of flasks and trucks are provided for each floor.

Fig. 4 shows the flask rolled over, with the machine in position just prior to drawing the pattern. The stripping plate is manipulated by a simple lever and toggle arrangement. The green-sand cores which form the spike holes are held in place by stopper rods while the pattern is being stripped out of the sand. The method of bolting the stoppers to flat steel yoke-straps on the back of the roll-over plate is clearly shown in Fig. 4. This illustration also shows the chains connecting with the counterweight.

The drag flasks are made of heavy cast iron. They are tapered to save sand, and are 2 feet 5 inches long by 19½ inches wide on top and 2 feet 3 inches by 12 inches on the bottom, the platforms of the carrying trucks, which serve as bottom boards, being 2 feet 5 inches by 14 inches. The molds are poured through one runner leading to two gates, each of which feeds the center casting and one of the end castings. The gating is clearly shown on the pattern-board and in the mold in Fig. 5. The spike holes in the patterns, which form the green-sand cores previously mentioned, are brass bushed to avoid corrosion. In fact the patterns are thoroughly finished in every particular. In Fig. 5, the gate is shown at *G* and the loose pieces on the pattern at *P*.

After fitting the flask to the roll-over board, there are 12 operations in molding the drag, as follows:

1.—Spread milled sand on rail-seat and gullet by hand and tuck.
2.—Shovel one shovelful of facing sand.
3.—Fill flask with black (hot) sand.
4.—Ram around pattern and continue to fill flask with black sand.
5.—Cross ram.
6.—Butt ram.
7.—Strike-off with handle of rammer.
8.—Vent mold with venting wire.
9.—Roll-over flask.
10.—Draw pattern.
11.—Draw loose pieces and replace them on pattern.
12.—Haul truck with completed drag mold away.

The flask-pins, as shown in Fig. 4, are square, fitting into square notches in the drag. The cope is clamped by a narrow wedge which is driven through a rectangular hole in the flask pin. The drag is clamped in the same manner

FIG. 10—GENERAL VIEW OF SAND MIXING DEPARTMENT

FIG. 11—ONE OF THE DRAG-MOLDING STATIONS SHOWING MOLDING MACHINE AND SAND HOPPER

for rolling-over on the machine.

The copes, which are also cast iron, are 19½ x 29 inches in dimensions and 3½ inches deep. Each cope is divided into 12 sand compartments by five cross bars and one longitudinal bar. The copes are rammed by hand on specially constructed stands which are located near the molding machines. These stands are provided with smooth cast-iron tops equipped with notches to receive the flask pins. A conical nosed rammer, shown in Fig. 6, is employed. This illustration shows the general arrangement of the cope-ramming station, including the steel plates which are set on edge in the floor to keep the heap of sand in place. At the left in this illustration is shown the arrangement for shaking-out the copes. Ordinary black sand is used in the copes, which are merely flat cover plates.

Six Men in a Gang

For handling the work, each unit is provided with two men for operating the molding machine, two boys for making the copes and closing the molds; one man for hauling the mold-trucks, called the bogey puller; and one man for unloading and wheeling out the finished castings. The bogey puller and his companion uncover the molds and shake-out the copes. Each molding gang, therefore, consists of six persons.

An average day's work for each unit is 20 casts of eight molds each, or 160 molds containing 480 castings, with an aggregate weight including the gates and sprues, of about 26,400 pounds or nearly 12 tons. The castings each weigh about 50 pounds and the gates, etc., about 5 pounds. Under favorable circumstances a single unit has turned out 26 casts in a day, this being equivalent to 208 molds, or 624 castings with a *net* weight of 31,200 pounds. The men are paid on a piecework basis.

A pouring gang is provided for each two molding units. Three such gangs, therefore, handle all of the metal that is required. Each pouring gang consists of a caster, or ladle man, and a skimming boy. They also are paid on a piece-rate basis. The cupolas have been in use for some time but were recently reconditioned and fitted with drop-bottom doors. These cupolas are 54 inches in diameter inside of lining and have a melting capacity of about 10 tons per hour. The rail-chair foundry melts approximately 80 tons a day—British long tons. The general arrangement of the cupolas, together with the charging floor and balanced elevator hoist, are shown in Figs. 12 and 13. The cupolas are operated on alternate days, and when working supply metal to the floors continuously. The first metal is tapped at 7:30 a. m., and from that time until 4:45 p. m., the wind is not taken off, except during the lunch hour. The tap hole is always open.

To handle the metal, a cap-shaped receiving ladle is employed. It is shown in Fig. 13, and has a capacity of about 3360 pounds. It was designed and built by the Smith-Patterson company, and is made of cast iron lined with loam instead of fireclay or bricks. The ladle is suspended from a trolley as shown in Fig. 13, and may therefore be used to serve either cupola. It has the usual hand-wheel and spur-gear tilting mechanism. The pouring ladles, which are hand tilted, have a capacity of about 1680 pounds, and are also lined with loam.

A Ten to One Ratio

Although the melting ratio, exclusive of the bed charge, is 10 to 1, the metal comes down very hot, and frequently it is found advisable to put a half a dozen sprues in the bottom of the pouring ladle. This also forms a convenient method of remelting the sprues.

Each cupola is equipped with one row of tuyeres made as nearly continuous as possible. The lower lips of the tuyeres are 2 feet 5 inches above the bottom, and a 9-inch sand bottom is employed. The charging door is 12 feet 9 inches from the bottom of the cupola. This is believed to be too low. Two more cupolas are going to be installed and after they arrive the charging platform will be raised 3 feet.

A fan blower furnishes the blast for the cupola at an average pressure of 20 to 21 inches of water. The fan is driven by a 28-horsepower electric motor.

Owing to existing conditions, the melting mixtures vary. The melt usually contains from 30 to 50 per cent scrap, the balance being made up with No. 4 Cleveland pig iron which has the following analysis: Silicon, 2 to 2.50 per cent; manganese, 0.45 per cent; phos-

FIG. 12—A BALANCED ELEVATOR SERVES THE CHARGING PLATFORM

FIG. 13—THE CUPOLAS ARE OPERATED CONTINUOUSLY ON ALTERNATE DAYS

phorus, 1.5 per cent; sulphur, 0.06 per cent; graphitic carbon, 3 per cent; combined carbon, 0.3 per cent. Except for the phosphorus, it is seen this iron would correspond to a No. 1 iron in the United States. From 5 to 10 per cent of steel scrap is used in the rail-chair mixtures. As far as possible the cupola design and melting practice corresponds to the practice recommended by David McLain, Milwaukee, author of "McLain's System." The fuel used is English by-product foundry coke.

A well equipped laboratory is provided and the mixtures are made up by analysis. There is laboratory control throughout the process. A test-bar is cast with every heat and subjected to a transverse test. The bar is of the standard size, 1 x 2 inches, tested between 3-foot centers. It must withstand a concentrated load of 28 British hundredweights, or 3136 pounds.

After the castings are taken out of the molds they are set down on the floor and allowed to cool slowly over night. This gives a mild annealing action. They are then cleaned by hand, the sand being simply brushed off. One man is employed for this purpose on each floor. The finished rail-chair and brake shoe castings finally are handled in a steel scoop by the traveling crane that covers the delivery end of the foundry. The crane runway extends out into the yard as shown in Fig. 9, where the castings either are deposited directly into railroad cars for shipment, or are piled up in bulk for future disposition, as shown in the illustration.

The rail-chair castings are used around the Smith-Patterson foundries for various unique purposes. For instance, the hot castings are employed for drying ladles. They also are similarly used for skin-drying molds in the jobbing shop. In addition, they make excellent flask weights.

As previously mentioned, in addition to the rail-chair and brake-shoe specialty shop which has been described, Smith-Patterson & Co. operate extensive jobbing foundries in connection with their plant at Blaydon-on-Tyne. These foundries handle general jobbing work up to over 20 tons in weight. Turbine casings for turbo-generator sets are a specialty. One of the products of this department is a 22-ton casting now doing service as part of a Parsons turbine installed in one of the plants of the Commonwealth Edison Co., Chicago.

In order to be independent of traffic conditions, Smith-Patterson & Co. also operate a coasting steamship of 350 tons. She is 135 feet long, 23 feet 6 inches beam, and 11 feet 3 inches in depth. This vessel was built by J. P. Rennoldson & Sons, Ltd., South Shields, England, for Smith-Patterson & Co. Originally named the BAYDONIAN, this little vessel had the distinction of sinking an enemy submarine during the war, and subsequently her name was changed to PATTERSONIAN.

British Foundrymen Meet Above Border

GROWING sentiment among British foundrymen to cooperate more closely with the foundrymen of the United States characterized the opening day's session at the annual meeting of the Institution of British Foundrymen held in Glasgow, Aug. 25-27. The members in attendance at the meeting voted unanimously to extend fraternal greetings to the American Foundrymen's association and to offer best wishes for the success of the Columbus convention. Before the meeting came to a close arrangements had practically been completed for the exchange of papers between the Institution of British Foundrymen and the American Foundrymen's association in 1921. The hope also was expressed that it may be possible in the not distant future to arrange an Anglo-American Foundrymen's convention at which men from both countries can meet and exchange views in a more intimate and personal manner than is possible under ordinary circumstances. Members of the institution who had visited the United States stated that the volume and scope of the American foundry industry together with the processes and systems that made such volume possible could not be realized except by actual presence and contact with American conditions. On the other hand they felt convinced that there were many commendable features about British foundry practice which would repay investigation and study on the part of foundrymen from across the sea.

The meetings for the presentation and discussion of technical papers were confined to two sessions held on Wednesday and Thursday mornings respectively, Aug. 25 and 26, at the Royal Technical Institute. Among the papers presented at the technical sessions were the following: "The Measurement of Casting Temperature in the Brass Foundry" by J. Arnot, G. & J. Weir, Ltd., Glasgow; "Science in the Workshop," by W. H. Cathcart, Blacksmith gold medallist of the British Iron and Steel institute, and "Future Research in Cast Iron," by J. H Andrew, professor of metallurgy, Royal Technical college, Glasgow.

The Wednesday meeting was preceeded by a business session at which the election of the new president, M. Riddell, Watson Gow & Co., Falkirk, Scotland, was announced. The formal installation of the new secretary, W. G. Hollinworth, formerly secretary of the Society of Heating and Ventilating Engineers, also was announced.

The Glasgow branch of the institution headed by J. Macfarland, William Jacks & Co., Glasgow, acted as host. The entertainment features included a civic reception by the lord provost and magistrates of Glasgow in the municipal building on Wednesday afternoon, Aug. 25 and an excursion to Loch Lomond on Friday. Thursday afternoon, Aug. 26 the works of the Singer Mfg. Co., at Kilbowie, near Glasgow, was inspected. This plant is owned by a company affiliated with the Singer Sewing Machine Co. of the United States.

The officers elected for the ensuing term were as follows: President, Mathew Riddell, Watson Gow & Co., Falkirk, Scotland; senior vice president, Oliver Stubbs, J. Stubbs, Ltd., Openshaw, Manchester; junior vice president, H. L. Reason, Birmingham; treasurer, F. W. Finch (re-elected); secretary, William G. Hollinworth, London. The members of the council are E. H. Broughall, Coventry; J. Jewson, Eastdereham; Alexander Hays, London, and J. Shaw, Sheffield.

The membership of the Institute now totals 1603 and reflects a steady and constant growth. It represents practically half the total number of foundries in Great Britain and Ireland and the 1921 meeting will be held at Manchester.

Akron Plant Started

Operation of the new plant of the Taplin-Rice-Clerkin Co. was started recently. It is said to be one of the largest foundries in northern Ohio and will be able to handle 25 tons of iron a day. Ten months have been consumed in construction of the plant, the building and equipment representing an outlay of $150,000. It will give employment to 150 men, a majority skilled mechanics. The factory is 80 feet wide and 360 feet long. Included in the equipment is a double smelter and a monorail system operated by compressed air. The plant is electrically equipped.

THE FOUNDRY DATA SHEET, SEPTEMBER 15, 1920

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

SPECIFICATIONS FOR CAST-IRON SOIL PIPE AND FITTINGS

(Concluded from Data Sheet No. 349)

(c) All pipe and fittings shall be of uniform thickness of wall and present true circles at the hub and spigot ends. A variation of 1/16-inch under the following dimensions will be permitted, but only when the actual weight is not less than the variation of the marked or estimated weight as given in tables I and II:

THICKNESS OF BARREL	3/16 inch
" BODY OF HUB	1/4 inch
" BEAD OF HUB	5/16 inch
" BEAD OF SPIGOT END	7/16 inch

9. (a) Weights and measurements of pipe and fittings shall be taken as those of plain uncoated pipe. All weights shall be given in pounds.

(b) Individual lengths of pipe and fittings may weigh 5 per cent less than designated in Tables I and II, but only when the average weight of a given size and weight of pipe and fittings selected at random is not less than that shown in Tables I and II.

(c) The regular length of pipe shall be such as to lay 5 feet including hub.

(d) The average weights of soil pipe and fittings shall not be less than those given in Tables I and II.

V.—Workmanship and Finish

10 (a) All pipe and fittings shall be practically straight and cylindrical and fittings true to pattern. The specified sizes shall be for the inside diameter and shall conform, within the allowable variation, to the dimensions given in the tables.

(b) All pipe and fittings shall be carefully examined for defects and sounded with a hammer before shipment. No fillings with metal, cement or other material, or so-called "burning on" of iron will be permitted. The castings shall be sound and free from cracks, sand holes, blow-holes and cold-shots.

VI.—Marking

11. All pipe and fittings shall be marked with the name of the manufacturer, or appropriate initial. Each casting shall have cast upon it the minimum or estimated weight of same as shown in Tables I and II.

VII.—Inspection and Rejection

12 The manufacturer shall afford the inspector representing the purchaser, free of cost, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works and shall be made prior to shipment, unless otherwise specified.

13. All pipe and fittings which fail to conform to the provisions of these specifications shall be subject to rejection.

The Foundry Data Sheet No. 350, September 15, 1920.

(Concluded on Data Sheet No. 350)

The Foundry Data Sheet No. 349, September 15, 1920.

Specifications for Cast-Iron Soil Pipe and Fittings

(Continued from Data Sheet No. 348)

Table II

Weights of Soil Pipe Fittings

Only the staple fittings are shown. From the data herewith the weights of other fittings may be calculated. All values are in pounds.

	Size of Fittings, Inches											
	2	3 by 2	3	4	4 by 2	4 by 3	5	5 by 3	5 by 4	6	6 by 3	6 by 4	6 by 5
¼ Bends, regular	6¾	10½	15	19	23½								
¼ Bends, short sweep	8¼	12½	17¾	22½	27½								
¼ Bends, long sweep	10¼	15¾	22	27½	33¾								
⅓ Bends	6¼	9¾	13¾	17¼	21½								
⅙ Bends	6	9¼	13	16½	20								
⅛ Bends	5½	8½	12¼	15¼	18¼								
1/16 Bends	5	7¾	10¾	13¼	15¾								
Return Bends	8¾	14	20¼	26½	33¼								
Tees	10¼	15¼	21	26½	33¼	13¾	16½	18¾	19¾	22	24½	22½	25	27½	30
Tapped Tees (tapped up to 2 in.)	8¾					11¾	15		17¾			20½			
Sanitary Tees	11														
Tapped Sanitary Tees (tapped up to 2 in.)	9	16¼	22½	28	34¼	14	17¼	19¾	20	23	25½	23 ·	26	29	31¾
Y Branch	11	17	24	31½	39¼	14	17¼	20¾	20	23½	27¼	23	27	31	35
¼ Y Branch	10¼	15¼	21¾	27½	34	13¼	16¼	19	19¾	22	25	22¾	25¼	28½	31
Tapped Inverted Y Branch (tapped up to 2 in.)	10¼	13¾	17¼	21	24										
Inverted Y Branch	11¼	18	25½	33	41¼	15	18¾	22	22	25½	29½	25¾	29¾	33	37
Combination Y and ⅛ Bend	12	18¾	27	35	44¼	15	18¾	22¾	21	25½	30¾	24	29	34	39
Upright Y Branch	12¼	19¾	28	36¼	46	15¾	18¾	23	21½	26½	31¾	24½	29½	35	40

Judging Sands for Foundry Use-I

Three Main Characteristics Which Must be Present in Good Molding Sand Are Defined and the Methods for Their Determination Are Explained

BY HENRY B. HANLEY AND HERBERT R. SIMONDS

SAND for foundry use possesses three characteristics, refractoriness, cohesiveness and porosity. The variation of one or more of those properties adapts a sand for different classes of foundry work. Scattered throughout the United States and particularly in the eastern portion, natural sands are found which have the properties ideally suited to certain classes of foundry work.

Foundry sands may be divided under the following general headings: Molding sand; core sand; facing sand; fire sand; gravel; high silica sand; and parting sand.

Molding sand usually is a mixture of quartz, feldspar and clay, having sand, sometimes carrying from 10 to 35 per cent of feldspar, and containing little or no clay substance or other bonding material. In its final mixture it always is an artificial sand in the strict sense of the word, for the bond is obtained through a separate binding material which is mixed with the clean sand. Such an artificial binder usually is based upon linseed oil, molasses, glutrin, glucose, resin, dextrin, flour or a pitch compound.

In addition to these a great number of patented or trade mixtures have been placed on the market, composed of one or more of the following substances; resin, soya bean oil, fish oil, linseed oil, and mineral oil. The question of binders for core sands is extensive and will be treated at some length later.

Fire sand usually is a coarse silica sand carrying, only small quantities if any clay and feldspar. These, if present, are impurities, as the ideal sand is pure silica. Fire sand is mixed with fire clay to make cupola and ladle linings and for other refractory uses in the foundry.

Aiding Escape of Gases

Gravel is a coarse silica sand combined with clay to make its use possible as a molding sand. Its function is to increase the porosity of a mold to allow greater rapidity in the escape of gases from large castings. It usually is mixed with other sands. As castings approach the ton size, porosity of the sand in the mold becomes of great importance in molding.

High silica steel molding sand is pure quartz and runs from coarse to fine grades. It must be free from impurities which would cause fusibility. It always is artificially bonded.

Parting sand is a pulverized fine quartz sand usually of a fineness to pass a 100 mesh sieve.

Different grades of all the varieties of sand mentioned are required for different classes of work. For example, a molding sand of fine texture, smooth face and medium strong bond is well suited to stove plate work, whereas, for medium size cylinder work a sand of coarse character with a strong bond would be best suited. It is this shading in the required properties of sand for different classes of work in the foundry which has brought into prominence many producing districts, each renowned for the particular sand which nature has given it.

Sand throughout an entire district often has the same general characteristic; thus the Albany district sands run fine in texture and are adaptable to the stove plate industry, as they produce what is known as a sharp finish. On the other hand, the so-called Jersey district sands are coarse with high silica content and a strong bond, and therefore are adaptable to large castings. The sand deposits at the southern end of Lake Michigan in many cases are found to be pure silica and of a remarkably uniform size of grain. Southern Lake Michigan sand, on its way to the Atlantic coast passes each week or perhaps each day Jersey sand which is trav-

FIG. 1—TYPICAL MOLDING SAND MAGNIFIED EIGHT TIMES

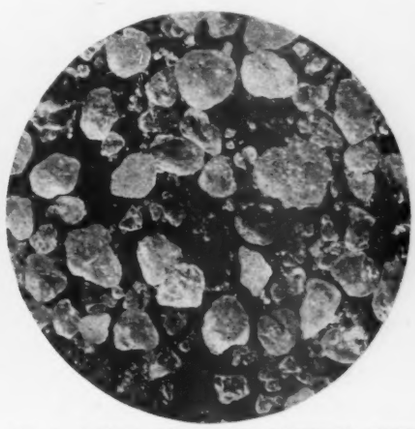

FIG. 2—TYPICAL CORE SAND MAGNIFIED EIGHT TIMES

FIG. 3—CORE SAND, SHARP GRAIN MAGNIFIED EIGHT TIMES

peculiar properties of holding a bond when tempered with a small quantity of water. The term molding sand often covers facing sand, the difference in the two being merely one of refinement in the bond property. The facing or face surface of any mold is the main factor in determining surface finish of the casting and it follows from this that when refinement of finish of a casting is essential a specially fine grained sand is necessary. However, some foundries have eliminated any distinction between facing and molding sand, using a homogeneous mixture which is sufficiently fine to meet their surface requirements for all purposes.

Core sand usually is a straight silica

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TABLE I

Chemical Analysis of Typical Sands

	*Molding Sand Per cent	†Core Sand Per cent	Facing Sand Per cent	Fire Sand Per cent	Gravel Per cent	‡Steel Sand Per cent	Parting Sand Per cent
Loss on ignition	3.05	.75	2.00	1.14	1.34	.45	.45
Silica (SiO_2)	82.10	95.25	88.52	94.00	84.18	97.55	98.01
Iron oxide (Fe_2O_3)	5.23	1.45	5.69	2.15	3.02	1.00	.30
Aluminum oxide (Al_2O_3)	7.70	.50	2.47	2.45	7.95	.61	.85
Calcium oxide (CaO)	.63	1.01	trace	trace	.44	.15	.10
Magnesium oxide (MgO)	.13	.42	.23	.08	.37	.21	.06
Sodium oxide (Na_2O)	trace	.15	.06	trace	.07	trace	trace
Potassium oxide (K_2O)	1.15	.10	.85	.05	2.51	trace	trace

*Medium.
†Coarse.
‡High silica.

eling west. Jersey sand has in fact been used quite extensively on the Pacific coast and was sent to Panama for making steel castings for the canal work. It has also been sent to the Philippines.

In almost any part of the United States a sand can be found close at hand which can be economically worked over to adapt it for foundry use. However, it must be understood that not all samples from the same district will have the same properties. Often it is possible to mix local sand with small quantities from a distant bank to produce the desired result. One of the great difficulties to overcome is the lack of uniform grain in most local or undeveloped pits. Where the lack of uniformity is not too pronounced sieves may be employed economically for grading. In the Far West there seems to be an actual scarcity of good foundry sand. However, there are materials in the back yard of almost any foundry which could be used to cut down the quantities of imported sand required, and which, without reducing the quality of castings, would effect a saving in freight charges and in molding sand costs.

From Table I, the general chemical characteristics of the different typical sands may be noted. Different sands may vary under chemical analysis, but the composition when checked with the physical or mechanical properties will give an idea of the availability of the sand for the purpose sought. Table II shows the results of mechanical analyses of different sands. In addition to presenting an indication of the relative fineness, this table shows the prosity or percentage of voids in the mass.

FIG. 4—COARSE FACING SAND MAGNIFIED EIGHT TIMES

FIG. 5—TYPICAL FIRE SAND MAGNIFIED EIGHT TIMES

FIG. 6—GRAVEL WHICH HAS BEEN MAGNIFIED EIGHT TIMES

Foundrymen for several years have had before them the results of chemical analyses of a great many molding sands from all parts of the United States. Little use, however, has been made of this information, for the interpretation of a chemical analysis is rather difficult even for a chemist, and it is not uncommon to find foundrymen who do not at all understand such an analysis.

The methods of making complete chemical analyses of foundry sand are known to most chemists doing general analytical work. Such analyses consist in making quantitative determinations of the different elements or oxides contained in the sample. The complete analysis, however, without interpretation has almost no value. It is not desired, for instance, to know the silicon content of a molding sand, for this alone, without some knowledge as to the form in which the element is combined in its physical state gives little idication of its effect.

On the other hand a careful chemical analysis *with* an intelligent interpretation is valuable to any foundryman. The silicon dioxide or silica (SiO_2) is the factor which is valuable in a sand analysis.

A chemical analysis usually gives only the determination of silica, alumina, ferric oxide, lime, magnesia, potassium oxide and sodium oxide. A typical chemical analysis of a molding sand appears in this form:

	Per Cent
Loss on ignition	3.38
Silica (SiO_2)	82.52
Alumina (Al_2O_3)	8.53

TABLE II

Mechanical Analysis of Typical Sands

	*Molding Sand Per cent	†Core Sand Per cent	Facing Sand Per cent	Fire Sand Per cent	Gravel Per cent	‡Steel Sand Per cent	Parting Sand Per cent
Sand retained on 20 mesh sieve	3.2	13.0	7.0	35.0	32.0	4.7	None
Sand retained on 40 mesh sieve	5.0	79.4	35.5	34.1	34.3	48.1	None
Sand retained on 60 mesh sieve	11.4	4.8	16.3	10.6	9.8	38.2	None
Sand retained on 80 mesh sieve	13.6	.6	4.8	7.8	1.1	5.2	None
Sand retained on 100 mesh sieve	6.2	.4	3.6	1.5	1.1	1.5	None
Sand retained on 150 mesh sieve	22.4	.5	2.1	1.8	1.3	1.0	10.5
Sand retained on 200 mesh sieve	9.5	.2	4.5	.4	1.3	.1	15.2
Fine silt 200 +	16.6	.3	10.4	2.4	3.6	1.2	74.3
Clay substance	12.1	.5	14.8	5.8	15.5		
Sharp sand	87.9		85.2		84.5		
Bond	12.1		14.8		15.5		

*Medium.
†Coarse.
‡High silica.

Ferric Oxide (Fe_2O_3).....	3.57
Lime (CaO)	.17
Magnesia (MgO)	.18
Potassium Oxide (K_2O).....	1.48
Sodium Oxide (Na_2O).....	.19

In looking over the percentages of the various constituents, misleading conclusions often are formed. A high silica content always has been understood to indicate that the sand was of a refractory character, but after a careful study of this determination, and of the possible combinations of silicates in a molding sand, it is seen that refractoriness is not necessarily dependent upon a high silica content in a chemical analysis.

The silica reported represents all the silica in the sand. It may be derived from feldspar and various other silicate combinations, found in natural molding sands. If the feldspar in a

FIG. 7—HIGH SILICON STEEL SAND MAGNIFIED EIGHT TIMES

sample runs high, the silica content also is high, but the refractoriness would not be as good as in a sample with low feldspar content, and perhaps a correspondingly low silica content. In the same way alumina, as indicated in the chemical analysis may represent part of the clay present, or of the feldspar, or of any other of several alumina bearing constituents occurring in natural sands. The general impression is that a high alumina content indicates a high clay sand, and thus a sand of strong bond. This impression is founded on two errors. The alumina may exist in constituents other than clay, or clay itself may be present with a comparatively weak bonding property. This naturally brings up the question of what is bond—which will be treated in detail in a later article.

Ferric oxide practically always is present as an impurity in natural molding sands, and its percentage, as shown by chemical analyses, often gives a good indication of the amount of bond in the sand. Ordinarily common sand, without bonding property, will show an iron oxide content of 5 or 6 per cent—whereas, in a molding sand the ferric oxide may run from 3½ to 15 per cent. The importance of iron content of a sand is not generally recognized, but from experience with a large number of sands with varying iron contents, it has been proved that a relation exists between the percentage of iron and the bonding quality. The iron content alone of course is not sufficient indication in some cases, for a sand containing 5 or 6 per cent may have almost no bonding property, or it may have a fairly good bond.

Lime and magnesia are classed as alkaline earths in a molding sand analysis, and their percentages should be as low as possible to avoid trouble arising from their fusion. They are melted easily and when present in any appreciable quantity they affect the finished appearance of the casting. Quantities up to 1 per cent of either lime or magnesia, will never give trouble. Sodium and potassium oxides usually are part of the feldspar content of a sand, and their percentages give a fairly reliable indication of the feldspar percentage. In any case these oxides are undesirable, for they are the most fusable of all the constituents. From this an idea is obtained of the importance of careful interpretation of a chemical analysis. A chemical analysis does not in any way indicate the physical properties of a molding sand, and since these properties are recognized as the most important, it is necessary, wherever possible, to supplement the chemical analysis with a mechanical analysis.

Mechanical Analysis

Steel sands and core sands carry no natural bond, being principally high silica grains, and the difference between one such sand and another, is not a question of composition, as much as it is of grain size.

The ultimate chemical analysis may be relied upon to serve as a discriminating guide between sands of different characteristics. A mechanical analysis of molding sand however, is easier to make, and gives far more practical information. No other test will give such an accurate indication of the grade of sand, the shape of particles, and the percentage of bond matter present. After a little experience, the mechanical test will closely indicate the working properties of a sand. The analysis commonly consists of a sieve test. Until recently, there has been no standardization of the number or size of sieves used in mechanical analysis work. Each individual must determine what is necessary for the work at hand. A great many of the fine stove plate sands contain grains that can be collected only on the 150 and 200-mesh sieves.

In addition to the chemical and mechanical analyses, a so-called rational analysis often is made to obtain information regarding the properties of the principal mineral constituents. This analysis shows the clay substance, the quartz and the feldspar. The clay substance is determined by separating out the feldspar and quartz from a sample of sand of known weight, and then subtracting the weight of the substances thus separated from the original weight of the sample. In a similar way the feldspar is determined by removing the silica. The difference between the weight of feldspar plus the clay, and the total weight of the

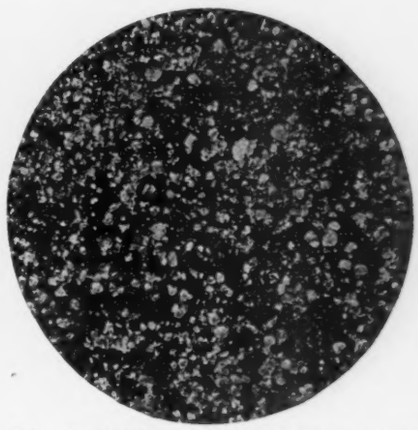


FIG. 8—PARTING SAND MAGNIFIED EIGHT TIMES

sample, gives an approximate weight of the quartz.

The rational analysis, while not accurate in any degree like the chemical or mechanical analysis, gives helpful data. It is a useful test in checking uniformity of sands from different localities. An experienced judge often can tell from a rational analysis, the locality from which the sand came. Sands high in feldspar fuse more readily than those of low feldspar content, and thus knowledge concerning the feldspar is of importance. The percentage of quartz found, through a rational analysis, indicates at once the approximate silica content, and this fact alone makes the rational analysis of great value in selecting sands for steel casting work, where the refractory quality is vital. The quartz content of a good refractory molding sand does not run below 90 per cent. The clay substance as determined in a rational analysis means little in regard to bond, since the method as used today is one of solution of soluble material in reagents, and not only the hydrated aluminum

TABLE III

Methods of Analysis for Sand

Determining Silica Content

ONE gram of a dried and finely powdered sample of molding sand is fused in a platinum crucible with 10 grams of sodium carbonate and 100 milligrams of potassium nitrate. After fusion is completed, the crucible is cooled, and the contents thoroughly disintegrated by the addition of hot distilled water. The contents of the crucible then is transferred to a large platinum pan where it is acidified with hydrochloric acid, and afterwards evaporated to dryness. The residue thus obtained is heated at 135 degrees Cent. for several hours to remove the last traces of hydrochloric acid, and to dehydrate the silica. Next the residue is treated with 5 centigrams of hydrochloric acid which is allowed to act 5 minutes, then the whole is diluted with 95 cubic centimeters of distilled water and placed on a steam bath to dissolve all the salts. Silica remains and is filtered off and washed with hydrochloric acid and hot distilled water, until free from iron. After washing, it is dried, ignited and weighed. This weight represents the total silica contained in 1 gram of the molding sand.

Aluminum and Iron Contents

ALUMINUM and iron oxides are obtained from the filtrate from the silica determination. This is diluted to 250 cubic centimeters by the addition of distilled water and a slight excess of ammonia is added. The solution then is boiled for a short time and allowed to settle. The precipitate, which consists of iron and aluminum oxides, is filtered off and washed with warm water, containing a little ammonia. It is then dried, ignited, and weighed. The result represents the total amount of combined iron and aluminum oxides contained in 1 gram of molding sand.

These oxides may be separated when desired, by use of hydrochloric acid and a zinc reductor. To do this, the combined oxides are placed in a platinum crucible with 10 times their weight of sodium carbonate, and the mixture is fused. The mass thus formed is dissolved in hot water, which has a small quantity of hydrochloric acid added to it. The iron is then reduced by running the solution through the zinc reductor and the ferrous content is titrated against potassium permanganate, and calculated to ferric oxide. This result when subtracted from the combined weight of iron and aluminum oxides gives the weight of the latter.

The filtrate from the separation of iron and aluminum may be used for the determination of calcium. For this five cubic centimeters of concentrated ammonium hydrate are added, and the solution is heated to boiling, when five grams of ammonium oxilate are added. This solution is usually kept boiling for 10 minutes as the calcium oxilate comes out of solution slowly. When the solution has cooled and cleared, it is filtered and then thoroughly washed with hot distilled water. The precipitate is calcium oxilate, which is dissolved in weak sulphuric acid, and titrated against potassium permanganate. From the amount of the permanganate used, the percentage of lime in the sand is readily calculated.

Determining Magnesia Content

THE filtrate is used for further determination and the next logical step is the magnesia test. The filtrate from the lime test is acidified with hydrochloric acid, and 3 grams of sodium phosphate are added. The whole situation is then evaporated until it has been reduced to 150 cubic centimeters. Next ammonia is added until the solution is neutralized, after which 10 cubic centimeters of ammonia is further added, in excess of neutralization. The solution is then cooled and thoroughly shaken, and ammonia magnesium phosphate, slowly precipitates out. It is allowed to stand over night and is then filtered through a Gooch crucible, washed with 10 per cent ammonia, ignited and weighed. The result gives magnesium pyro-phosphate, which multiplied by 0.3619 gives the magnesia in 1 gram of the molding sand.

Determining Sodium and Potassium Contents

FOR the sodium and potassium oxides, a fresh sample of sand is used. Two grams are dried and finely powdered, and heated with a mixture of one part of ammonia chloride and eight parts of calcium carbonate. By this means the alkalies are obtained in the form of chlorides, while the remaining constituents are for the most part, left behind as oxides. The silica is changed to calcium silicate. Alkali chlorides, together with the calcium chlorides, can be removed from the sintered mass by leaching with water. The other constituents remain undissolved. The sintering is carried out by gradually raising the temperature under a platinum crucible, until the lower portion of the crucible is brought to a dull red heat. This temperature is maintained for about one hour, after which it is allowed to cool, and the sintered cake is removed by gently tapping the crucible. The cake is then heated for about one hour with 50 to 75 cubic centimeters of water in a large platinum dish. It then is broken up into a fine powder by rubbing with a glass pestle, and is again washed and filtered until the filtrate gives only a slight turpidity with silver nitrate. The filtrate is then treated with ammonium hydrate and ammonium carbonate and heated and again filtered. The precipitate contains small amounts of alkalies, and is, therefore, redissolved in hydrochloric acid, and the previous precipitation repeated. The combined filtrates are evaporated to dryness in a porcelain dish, after which, careful ignition over a moving flame removes any ammonium salts which may be present. The residue is cooled and dissolved in a little water, and the last traces of calcium are removed by the addition of ammonium hydrate and ammonium oxilate. Calcium oxilate is then obtained by filtering. The filtrate is evaporated to dryness, ignited and weighed. Further refinements are necessary for careful work, but this weight represents the amount of alkali chlorides present with fair accuracy.

To separate the potassium, the residue is redissolved in water. The potassium is then precipitated as potassium chlorplatinate, filtered through a Gooch crucible, dried and weighed. This weight is then calculated to chloride, from which the weight of potassium oxide can be obtained.

silicate (clay) but other silicates which are soluble, pass into solution and are reported as clay substance. Therefore, the clay determination through rational analysis must be used with care.

Bond Absorption Test

A more reliable test for determining bond is known as the bond absorption test. This consists of introducing crystal violet dye into a solution containing the colloidal matter of a sand sample. This dye has the peculiar property of being absorbed by colloidal substance in a definite and constant amount proportional to such substance. Thus a definite amount of colloidal matter is necessary to take up a definite weight of crystal violet dye. After having obtained a solution of colloidal matter, the method of determining the weight of dye which it will absorb is briefly, as follows:

Dye crystals gradually are added until after thorough mixing, a slight tint remains constant in the solution. This means that more of the dye has been added than can be taken up by the colloidal substance. The same tint which exists in the solution under test, is then obtained by introducing a known amount of dye into pure water solution. The amount of dye absorbed by the colloidal matter then is the total weight of dye introduced into the solution under test, less the weight in a water dye solution, having the same tint. Some inaccuracies develop in this test, due to the fact that suspended matter remains in the liquid containing unabsorbed dye, and this prevents an accurate tint comparison. A refinement of the test is possible, however, for the dye can be completely taken out of solution by mordanted cotton yarns.

Test is Accurate

It is safe to say that no other physical test gives so close an estimate of the quality of bond of a molding sand as does this one of bond absorption. It provides an almost perfect means of comparing the actual quality of bonding material of one molding sand with that of another. However, the test when used on widely different grades of sand is not infallible as ordinarily conducted. This is due to the fact that some colloids affect the absorption of dye stuffs from the solution in a different manner from others. Fortunately in the majority of cases this difference in effect is not sufficient to introduce a detrimental error. The amount of bond substance existing and the strength of bond of a molding sand are, contrary to the general impression, not directly related, and it is this fact, more than

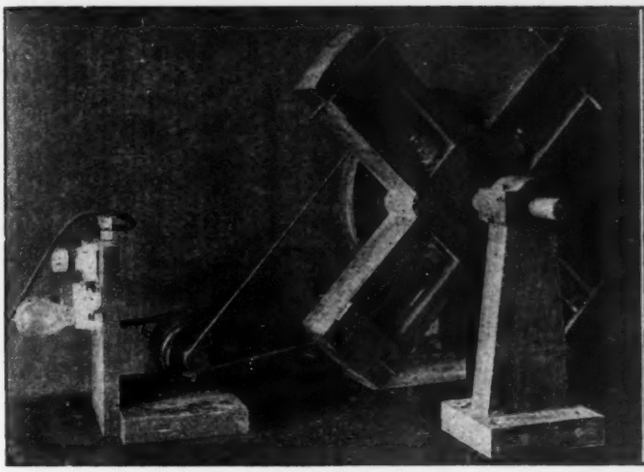


FIG 9—STIRRING MACHINE FOR ROTATING JARS IN BOND ABSORPTION TEST AND MECHANICAL ANALYSIS

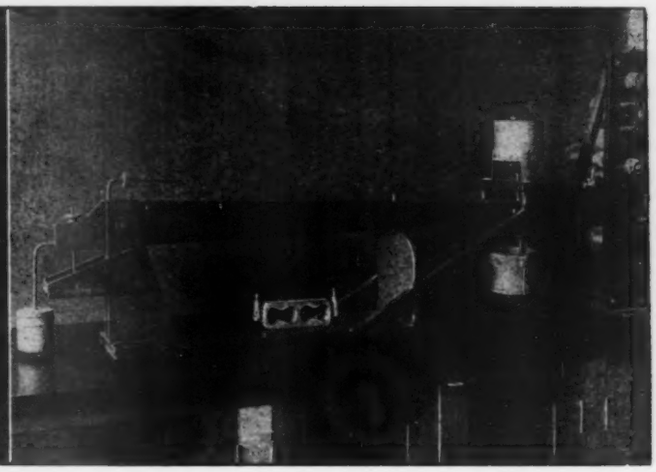


FIG. 10—TRANSVERSE TESTING MACHINE FOR STRENGTH TEST ON SANDS

any inaccuracies in bond adsorption tests, which has introduced error into the work of many investigators. The bond itself is influenced by the surface area of the sand as a predominating factor. For instance, the bond test performed on a sample of sand, will indicate a definite quantity of colloidal matter present; yet the surface area of the sample may be low, if the sand is coarse, or may be high, if it is fine, and the bond will vary accordingly.

Imagine the total surface area of the sample, that is, the area of the surface of each individual grain, spread out and pieced together to form a flat surface. Such a surface made up from a coarse sand would be small, and from a fine sand, large. Therefore, if there is the same amount of colloidal matter to spread over one surface as the other, then it is obvious that the smaller surface will receive the thicker coating, which means that it would have a stronger bond. In other words, with a definite amount of colloidal matter present in a sand, the coarser the grain, the stronger the bond. This is true within ordinary limits. In a sand which is too coarse the effect of reduced contact area between the particles tends to counteract the increased bond density.

Results of the bond adsorption test always must be linked with data concerning the grain size of the sand, otherwise, the test is relatively valueless. This introduces the term, density of bond. The amount of colloidal matter divided by the surface area of a sand gives the bond density, and this furnishes a much more reliable guide to relative bond strength of sands, than any other single quality.

An additional point to consider irrespective of areas, is the shape of grains and the amount of void. The effect of variation in these qualities on the cohesion of sand particles in a mold can be determined to some extent through experience with different sands. The amount of void may be approximated from the results of a sieve test. Evenly graduated amounts remaining on the different sieves indicate a low void. That is, if a curve were drawn representing the amount of sand remaining on each successive sieve, a smooth line continually increasing or decreasing from the coarsest sieve to the finest sieve, would show a sand to have far less void than an irregular line running up and down from one sieve to the next.

Transverse Test

As a further indication of bonding value of sands, a transverse strength test is often made. This has proved to be an interesting line of investigation, and frequently develops information of value in checking the strength of heap and facing sand on the foundry floor. The details of this test may vary a great deal, but the method always is the same, and consists of making up specimen briquettes which are later tested for transverse breaking load, much as a beam would be tested. The test serves as a guide to the strength of sand, whether or not the sand is new or has been in use for making castings a number of times, and is important for this reason.

With the intention of bringing the foregoing tests within the scope of almost any plant, some detail of apparatus is presented in the accompanying Fig. 10. In the usual chemical analysis the determination of silica is made as shown in Table III.

The loss in weight on ignition is obtained for a sample of sand by heating one gram of the finely powdered sand in a platinum crucible for one-half hour, over a high temperature bunsen flame. The crucible then is cooled in a desicator and weighed. The difference in this final weight and 1 gram, represents the water of hydration, the organic and the volatile matter present in the sand. These determinations constitute the chemical tests most easily made in a typical analysis. The rare constituents present seldom are determined, as little is known concerning their effect when present in molding sand.

The mechanical analysis, or sieve test, may be made as follows:

Weigh 25 grams of sand in a 500 cubic centimeter bottle, and add 250 cubic centimeters of water containing 25 milligrams of caustic soda. A glass stopper is sealed in the bottle, and it is then placed in a rotating machine, where it is stirred for one hour. One form of such machine is shown in Fig. 9. This process separates the clay substance and the colloidal matter from the grains of sand. After the separation is complete, the sand is washed onto a set of sieves, in sizes varying from 20 to 200 meshes per square inch. A strong stream of water is played on each sieve, and this forces the small particles with little difficulty through the coarser sieves, so that the entire operation may be completed in 10 minutes. The apparatus for this is shown in Fig. 11. The clay substance and the colloidal matter are so finely divided that they remain in suspension in the wash water. This is stirred and allowed to settle for five minutes, and then decanted off. When all the sharp sand has been separated in this way and accounted for, the difference between the total weight and the amount of material taken, represents the clay substance and colloidal matter present in the sand. Although no standard has been adopted for the sizes of sieves employed in mechanical analysis, a convenient arrangement consists of the following sizes:—20, 40, 60, 80,

100, 150 and 200 meshes per square inch.

The rational analysis for the determination of clay is made as follows: One gram of finely ground and dried molding sand is weighed into a 150 cubic centimeter glass beaker and 15 cubic centimeters of concentrated sulphuric acid are added. The mixture is stirred well, and allowed to digest for 12 hours at a temperature high enough to make the acid fume.

The solution then is cooled, diluted with 100 cubic centimeters of 10 per cent caustic soda solution, after which it is boiled for 30 minutes, then filtered a second time through a gooch crucible, washed with 1 per cent solution of caustic soda, and finally washed with about 50 cubic centimeters of 25 per cent hydrochloric acid. The residue is washed with hot water until the washings are free from chloride.

FIG. 11—APPARATUS USED IN MAKING SIEVE TEST

It then contains the feldspar and the quartz, and when burned to constant weight, gives a value which subtracted from 1 gram, closely indicates the weight of clay substance in the sample.

To separate the feldspar from the quartz in this residue, it is fused in a platinum crucible with five times its weight of sodium carbonate. After complete fusion the mass is placed in a beaker, and dissolved in water, the solution is acidified with hydrochloric acid, and evaporated to dryness to remove silica. Next the residue is treated with 5 cubic centimeters of concentrated hydrochloric acid, and 100 cubic centimeters of water. This solution is brought to a boil which permits the silica to be filtered off. The filtrate contains the alumina of the feldspar. This is removed by neutralizing the acid solution with ammonium hydrate, boiling for a few moments, and filtering. The precipitate is washed with hot water containing a few drops of ammonia, then dried and ignited. This precipitate is aluminum oxide, and since feldspar contains 18.34 per cent of aluminum oxide, the total amount of feldspar in the 1 gram of sand, is approximately 5½ times the weight obtained. The amount of quartz in the sample is closely indicated by the difference between the feldspar and the clay, as determined through the test mentioned.

The bond adsorption test is made by placing 25 grams of the prepared molding sand into a 500 cubic centimeter, wide-mouthed bottle, and adding 250 cubic centimeters of distilled water, and 5 cubic centimeters of 10 per cent ammonium hydroxide. The bottle after sealing with a glass stopper and parraffin wax, is placed in a rotating machine for one hour. At the end of this period, 140 cubic centimeters of distilled water are added, together with sufficient acetic acid to neutralize and leave an excess of acid. This usually requires 5 cubic centimeters of 10 per cent acid. In this state, the surface of each microscopic particle of the colloidal matter attracts or absorbs the dye. Sufficient dye is added to insure a slight excess, after the complete adsorption. The bottle is then sealed and agitated in a rotating machine for two hours. After removing the bottle from the machine, it is allowed to stand for a few hours, until the coarser particles have settled to the bottom. A beaker is then filled with 100 cubic centimeters of the top portion of the liquid, together with 25 cubic centimeters of water and two cubic centimeters of 10 per cent acetic acid.

Removal of Dye

While the beaker is held at room temperature, a 5-gram skein of mordanted cotton yard is introduced. The temperature is then graually raised through a period of 40 minutes to 60 degrees Cent., by which time, through careful movement of the skein, all the dyes should be removed from the solution, and the suspended matter from the molding sand should be left behind. The skein is washed and dried at 75 degrees Cent., and a comparison of its color against a standard set of skeins, gives the amount of dye which has been taken from this solution. The usual arrangement of standard skeins is made by depositing on each of six skeins 6, 8, 10, 12, 14 and 16 milligrams of crystal violet dye.

To make the transverse test, 400 grams of molding sand are tempered with water, up to the point where the sand is saturated. It then is rammed in a cement briquette mold, such as shown in the center of Fig. 10. A standard mold gives a 1 x 1-inch cross section at the center. The specimen after being removed from the mold is dried over night and then held for three hours at 100 degrees Cent. in an oven. After this, the specimen is set up in a suitable transverse testing machine. Such a machine should have a breaking capacity from 1 to 150 pounds per square inch. A convenient form of machine is shown in Fig. 10. The briquette is introduced at the left, and shot from an upper container, near the end of the lever arm is allowed to gradually run into a lower container, suspended from the arm. At the point of rupture the flow of shot is immediately shut off, and the weight of that in the lower container, indicates the transverse strength of the briquette.

It will be seen from this, that a great deal of work is involved in the complete examination of a sample of molding sand. The straight mechanical analysis test which can be readily made by any one, through the use of the simple equipment shown in Fig 11, will give a great deal of helpful information to the molder. In fact, for venting problems, this test is all that is required. In dealing with the problem of bond, however, reliable determination can only be made through a combination of the bond adsorption test, the mechanical analysis, and the transverse strength test.

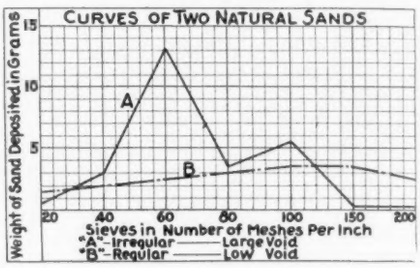


FIG. 12—COMPARISON CURVES OF TWO NATURAL SANDS

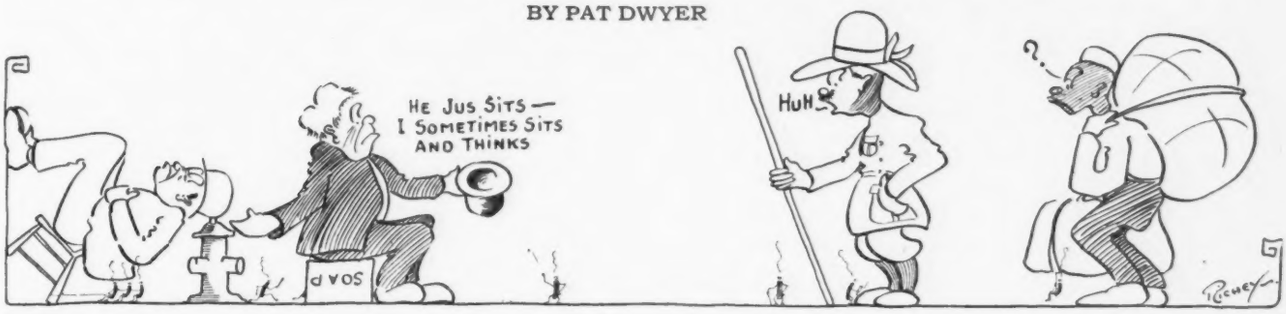
Buys Respirator Patents

Willson Goggles Inc., makers of industrial eye-protectors announce the purchase of all patents, trademarks, machinery and good will of Walter Soderling, Inc., 347 W. Broadway, New York, makers of respirators. Hereafter, respirators covered by the patents of the latter company will be manufactured at the Willson factory, Reading, Pa., under the personal supervision of Walter Soderling.

The University of Wisconsin offers its engineering students special facilities for becoming familiar with electric furnace operation. The electric furnace laboratory contains a heroult and a girod furnace of 450 and 150 pounds capacity respectively, besides smaller furnaces for making ferro-alloys. An electric brass furnace will be installed shortly.

Bill Takes the Bait of the Promoter

BY PAT DWYER



THE story has been credited to different people at various times but I first saw it in the *Youth's Companion* many years ago and you know how first impressions influence one. That magazine claimed that Norman Duncan brought it back from up Labrador way, where he spent several seasons visiting and gathering material for some of the stories which later made him famous. The episode to which I refer occurred in one of the little hamlets which are scattered at infrequent intervals along the coast of Newfoundland from Cape Race to the Straits of Belle Isle. These communities are as far removed from contact with the outside world as if they existed on another planet. Passing in front of the only store in the place one day Duncan saw several men sitting on a bench by the wall. He attempted to engage one of them in conversation, but experienced considerable difficulty in finding a topic of interest. Finally he asked how the men whiled away their spare time and received the astonishing, if somewhat philosophical piece of information "Oh, sometimes we sits and thinks and sometimes we just sits."

I was just sitting the other night, my mind a delightful blank, and with nothing to bother me as far as I knew until the whistle should blow in the morning. I was brought back to the cruel realities of life by a very young lady who perched herself on one arm of my chair and who told me in that peculiar form of language which very young ladies pick up, no one knows where, that she was up a tree and did not know how to get down. I replied properly that young ladies should not climb trees, but since she was in that embarrassing position the best thing she could do would be to creep out along the limb and drop off. This well meant and fatherly piece of advice apparently went over her head for she not only failed to move, but held up for my inspection an arithmetic and a scribbler and directed my atention to a question in the former which she claimed had been the cause of sending her up among the branches. I read the question over carefully and gathered that the kind old gentleman who had written the book had dug a cellar 20 x 40 x 6 feet deep and he wanted to know how many cubic feet of concrete would be required to build a wall 2 feet thick around this cellar. He also expressed a desire to be told how much the job would cost at $3 per cubic yard. I pointed out to the young lady that the man should have found out all those things before he started the job, any concrete man could have advised him, and privately I had my doubts about his being able to get any person to supply concrete at that figure. I then proceeded to elaborate further on the theme by pointing out that the specifications were too indefinite. They did not state whether the owner or the contractor was to supply the lumber and build the forms. There was no time limit set and there was nothing said in reference to the relative proportions of cement, sand and rock, factors which generally are recognized as exercising a direct influence on the cost of concreting operations.

Several other points which might have been touched upon with pleasure and profit were not alluded to because the young lady's mother, who is gifted with a singularly direct manner of speech, if you get what I mean, said to me "Why don't you tell the child what she wants to know instead of trying to air your knowledge of who's who and what's what in the concrete industry?"

While debating in my mind whether the retort courteous would be in order or whether I should follow the line of least resistance and say nothing as usual, the door opened and Bill entered.

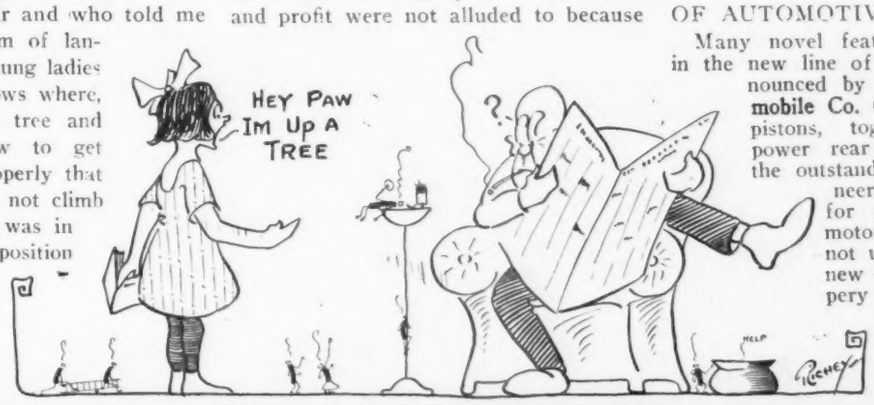
"Greetings" said he. "Greetings and salutation, I trust I am not intruding or interrupting a little friendly seance."

With the laudable intention of aggravating the lady who hates nothing so much as reiteration, I carefully went over the facts in the case under discussion prior to his arrival and at the conclusion asked his opinion on the subject.

"Well now," said he. "That is what I call a coincidence. I came over on purpose to show you a clipping from the old home paper. It is the most extraordinary thing I have ever read." He handed me the clipping from the *Apahaukee Advocate* and while I was reading it he took the little girl on his knee and showed her two different methods for working her arithmetical problem.

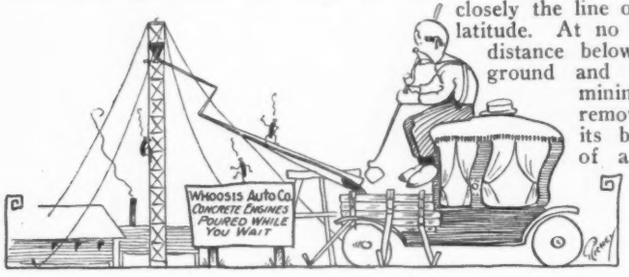
The clipping was headed RADICAL DEPARTURE IN AUTOMOBILE ENGINE CONSTRUCTION—TURBINE PRINCIPLE SUCCESSFULLY APPLIED TO PROPULSION OF AUTOMOTIVE VEHICLES.

Many novel features are embodied in the new line of trucks recently announced by the Whoosis Automobile Co. Concrete motors and pistons, together with water power rear axles are perhaps the outstanding features. Engineers have experimented for years with concrete motor construction but not until the advent of a new and exceedingly slippery cylinder lubricant has the proposition become practical. The oil has such a bearing on the feasibility and success of the



PROBLEMS IN CONCRETE TOO MUCH FOR DAUGHTER

motor that a word about its origin may prove of interest. Away back in prehistoric times before whales and other warm blooded animals had become accustomed to water, millions of them were drowned in a great flood. In the course of time the waters receded leaving their huge bodies resting on the dry land. The direct action of the sun caused the blubber to liquify and permeate the sands making what the geologists call a whale shale formation It will thus be seen that this oil is of animal rather than a mineral origin and when used in conjunction with castings made of concrete it transforms them into shale once more —a very slipperly substance.



NO HOT METAL TO POUR HERE

The Whoosis trucks are not provided with transmissions as the term usually is understood. Power is transmitted to the rear axle, but not through a shaft and set of gears. The motor operates a pump which forces water under tremendous pressure into a tank under (not on) the driver's seat. Any person who is competent to water a lawn can safely be entrusted with the duties of driving one of these trucks. The first models built are for right handed drivers, but it is proposed to develop another model for the benefit of those who do not know their right hand from their left. To start the car the driver simply turns a valve which admits water from the tank to a turbine on the rear axle. After its force is spent the water is returned to the pump by gravity and may be used over and over again until it has lost its viscosity and therefore has no kick in it.

Particular attention is called to the air line bodies. The Whoosis people believe that they are the first in the field to introduce the beautiful into truck design and point with pride to the extremely pleasing effects produced by the dump body, job *A*, stream line Fleetwood creation with an elegant cab top, a la Michael Angelo, and side curtains by Lucille and Lady Dandelion-Dutton who collaborated throughout on the color scheme and the quality of the fabric.

The Whoosis company is to be congratulated on its commendable enterprise in carrying this proposition to a successful issue and making it a commercial success. Immense factories have been built and equipped at the outcroppings of the Portland cement mother lode on the Atlantic and the Pacific, one at Portland, Me., and the other at Portland, Oreg. Expert surveys have proved to the company's satisfaction that the cement formation extends across the continent, following closely the line of the 45th parallel of latitude. At no place is it any great distance below the surface of the ground and the open system of mining will be employed in removing the cement from its bed. In consideration of a 99-year lease of a right-of-way from the federal government the company binds itself to remove the cement in two parallel strips with an intervening body of land left between them. In the bottom of the first strip a 6-inch thickness of cement will be left undisturbed and will serve as a national highway across the continent, while the other will tap the Great Lakes and form a continuous canal from the Atlantic to the Pacific, and cut off approximately 6000 miles from the passage of water borne freight between eastern and western sea-board points. The Whoosis company is contemplating the construction of a fleet of giant trucks and another of huge self-propelled barges, both equipped with their famous double action toggle jointed, reversible, slippery concrete engines, and expects eventually to carry all transcontinental freight. No provision is being made for taking care of passenger traffic, because to quote the president, Mr. McWho: 'The substitution of concrete for cast iron in automobile engine construction is bound to revolutionize the industry and place the automobile within the reach of every one. I look forward confidently to the day when the automobile will be considered as much a part of the furnishing for a home as a stove, a bed or a victrola!'

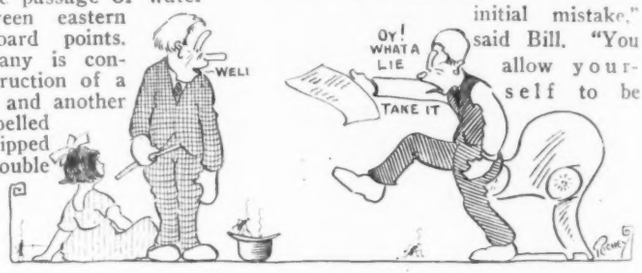
"Well" said Bill, when I had finished reading this remarkable statement and had handed the paper back to him: "How does the proposition hit you?"

"To tell you the plain unvarnished truth," I said, "It appears to me that it would require at least two strong men to believe that remarkable narrative. I often have heard of automobile engines in the abstract but this is the first time I have ever heard of one in concrete."

"Quite so," said he, "Quite so, my dear Watson, I think that I have frequently pointed out to you that you lack the gift of imagination. You are fairly reliable in grasping the details and analyzing what is perfectly obvious; but in the finer points of the game, in formulating theories based on facts which are not readily discernible; in constructing hypotheses; in drawing inferences and deductions you are sometimes singularly—er—if you will pardon the expression—er—obtuse. Please pass the cigarets."

"All right," I said, "I'm thick, I'll even go further and submit to being the goat if you can show me how that hare brained proposition can be taken seriously by any normal person."

"That is just where you make your initial mistake," said Bill. "You allow yourself to be prejudiced against the thing in the first place and therefore you look at it through biased eyes. Your judgment is warped and you jump to conclusions without inquiring into all the circumstances surrounding the case. Let us consider this thing carefully, taking it point-by-point in an impersonal manner. I am inclined to think that the proposition is not so



IMAGINATION OR PREVARICATION?

NOTHING INTERRUPTS BILL'S DREAM OF CONCRETE MOTORS

utterly impracticable as you seem to think.

"In the first place the statement appears in a perfectly reliable newspaper, one of the bulwarks, as we often proudly assert, of our civilization. You know that not more than 99 per cent of the statements in our newspapers are ever successfully contradicted or denied in later editions; and therefore this statement has mathematically one chance in a hundred of being the truth.

"Then the name of the company, the Whoosis Automobile Co., what a musical liquid sound it has. By placing the accent on the last syllable of the first word you can almost hear the water leaving the discharge end of the pipe and impinge with resistless force on the vanes of the turbine. By placing an imaginary interrogation point after the word, one could imply a certain amount of doubt in the company's integrity, but that implication is too far fetched to be worthy of serious consideration.

"We now come to what in my opinion is the most convincing item in the whole chain of evidence. I refer of course to the drowning of the whales. There is abundant evidence both in sacred and profane history to support this statement. If my memory serves me correctly you will find in Genesis VII, 21-23 a detailed account of that interesting if somewhat melancholy event. There is no direct statement to support the theory that the whales all perished in one place, but you are familiar with the saying, 'Birds of a feather flock together,' and while it is true that a whale is not a bird, it must be borne in mind that the expression is always used in a generic sense and is just as applicable to whales as it is to the poor fish who usually prompt people to make application of the proverb."

The lady who does me the honor of wearing my name and spending my money and who as I remarked before speaks directly to the point took it upon herself to gum up the works by remarking:

"Bill, I hate to turn you out in the cold and the darkness, but here's your hat and there's the door and when you get home you can tell your wife that she has my sympathy in having to flock with a bird like you. I have heard some birdie stories in my time but that is the limit."

"All right" said Bill with a grin as he winked at me, "I'll be on the way but don't be surprised if I come back in a week or so to sell you a concrete block of stock in the Whoosis Automobile Co., of America, Inc."

Coal for Facing Becomes Difficult to Secure

SEA-COAL facing is an article employed in practically every foundry devoted to the production of gray-iron castings. It is mixed with the sand which comes in contact with the pattern, in varying proportions. These range from 1 to 6 in the case of heavy castings up to 1 to 12 for light work. The gas evolved by combustion, when the molten iron comes into contact with the coal in the sand forms a cushion between the molten iron and the sand of the mold prevents the metal from burning into the sand. A limited number of castings are produced in molds in which no sea-coal facing is used, but the great majority of casting users insist on a clean, smooth face and this feature necessitates the use of sea-coal in the facing sand. The amount used in various foundries ranges from one ton or even less a month in the smaller foundries up to 200 tons a month in some of the large automobile shops.

Two of the largest manufacturers each produce 8000 tons a month of this commodity while a third supplies approximately 4000 tons. In addition to these large companies several smaller companies turn out a considerable quantity and a few foundries have mills in which they prepare their own facing. A conservative estimate places the entire monthly consumption of sea-coal facing in the United States and Canada at 25,000 tons.

This is a comparatively insignificant amount when compared with the millions of tons of bituminous coal raised from the mines every month, and ordinarily no difficulty was experienced in securing all the coal necessary for foundry purposes. However, at the present time, owing to a variety of causes, it is becoming increasingly difficult, and in some cases impossible, to secure coal enough to keep the facing mills operating. The supply houses report unfilled orders dating back from one to six months. One house shipped 31 tons last week completing a 200-ton order book last April.

A scarcity of rolling stock and the recent priority orders of the interstate commerce commission are directly responsible, among other things, for the acute stage in the facing situation. Under a ruling of the commission the railroads are guaranteed a supply of coal, while the amount has to be rushed through the lake ports on its way to the Northwest before navigation closes, places a heavy burden on the coal distribution facilities of the country. It is not a question of the mine owners' ability to raise the coal from the mines. That point is conceded when it is realized that many mines are operated only two days in the week; not from any lack of desire on the part of the owners or from a scarcity of labor, but simply and solely because no cars are available to take the coal away.

The contention is sometimes advanced that it would tend to stabilize production and shipping conditions if the mining companies maintained a steady and fixed output for every working day. When the required number of cars was not available the surplus coal could be *banked* as it is in some mining regions in other countries and this reserve could be drawn upon when cars were plentiful and conditions warranted.

The objections to this idea are that a large space would be required to store the coal; it deteriorates more or less from adverse weather conditions and therefore is not so marketable; it would require additional and expensive machinery and equipment to unload the coal and reload it later, thus adding to the cost of production, and there is always the danger of spontaneous combustion. Whatever the reason, the fact remains that no reserve stocks of coal are maintained at the mines. Coal is raised when cars are available and when there are no cars the mine remains idle.

A few mines favorably situated near navigable rivers are equipped to ship both by rail and water and thus are enabled to operate practically every working day. These mines of course with their overhead expense distributed over 4 or 5 days a week are enabled to produce coal at a much lower cost than the mines operating two days a week and forced to apportion their overhead on that basis. Since there is no competition, the more favorably situated mines receive the same price for their coal which the two-day a week mines have been forced to set on their product to enable them to stay in business.

The small wagon mines, so called because their product is hauled away in wagons or trucks, are not included in the priority order issued by the interstate commerce commission and consequently coal from these mines can be bought in the open market.

However the output of these mines is limited and their prices are based on prevailing market conditions. Neither coal producers or buyers are making contracts and there is no prospect of an easing in the coal situation until the end of November when the ports of the Great Lakes will be officially closed to navigation.

Customers for sea-coal facing are complaining bitterly that the supply houses are increasingly delinquent in filling orders and are even frequently refusing to accept orders as well as charging greatly increased prices for the limited amount of material which they do deliver. The supply houses on the other hand declare that they cannot get the coal and are forced to pay exorbitant prices for the comparatively small amounts which they they can pick up here and there. They are refusing to accept a great volume of business and the orders they do accept are based on the understanding that the customer will pay any increased price necessary to secure the coal in an uncertain market. In no case is any definite delivery date assured.

Scientific Methods Needed in Foundries

BY DR. JOHN E. STEAD

MANY years ago, when lecturing on science in the foundry, on one occasion I astounded the foundrymen present by the statement that, until the foundry industries appreciated the fact that the services of a trained metallurgical chemist were at least as necessary as those of a time-keeper, there was no hope for them. Today nearly every large foundry depends on the chemist for the synthetic control of the iron charged into the cupola, and the smaller establishments, where the output does not justify the establishment of a chemical laboratory, recognize that it is necessary to know the composition of the various consignments of raw material delivered to them, and would indeed be thankful if the pig iron manufacturers would supply them with analyses of all consignments. Few can conceive what prejudice existed a few years ago in the minds of those who controlled the mixing of metals in the iron foundries. These gentlemen did not realize that although the fractures of the pigs they used might be the same in different consignment from any single firm of pig iron makers, the composition varied to a considerable extent, and that corresponding variations resulted in their castings. At one works where advice was given how to prepare synthetically suitable meltings from local irons to replace more expensive material imported from a distance, the foreman expressed the view that the expert was a most dangerous man. In more than one establishment it is beyond doubt that when a chemist was introduced and his advice taken, something was done to produce a bad result. Before real progress could be made the foremen had to be replaced by men less prejudiced.

That cast iron of almost any desired properties could be produced, given the necessary varieties of raw pig irons, had been proved long ago, even in the early seventies, by one firm in this country which synthetically produced, and still produces, almost any kind of iron required, namely: White iron suitable for carburizing in the manufacture of crucible steel; iron having all the properties of cold-blast iron; iron suitable for the manufacture of chilled rolls, malleable castings, etc.; but this was only possible because, from the first, chemical assistance was employed. It is now generally admitted that the peculiar properties of every brand of iron are due to differences in composition.

Perhaps the greatest advance in foundry practice followed the researches of Professor Thomas Turner on the influence of silicon on cast iron. The astounding practical evidence of Charles Wood of Middlesbrough subsequently proved that by melting together two classes of iron from the same blast furnace, each of which was absolutely unfit to use by itself, a mixture was obtained which yielded high-class castings. The irons referred to were white iron and so-called "burnt" glazed iron, the former being deficient in silicon, the latter containing about 4 per cent of that element. Each iron was brittle by itself, but the mixture was good and even better than average foundry castings made from Nos. 3 and 4 foundry Middlesbrough irons. The market value of each of these irons (white and glazed) was low, and it was usual to put them back into the blast-furnace in small doses, thus working them off with the better metal. The value of such high-silicon glazed iron since that time has been recognized, and is in great demand at works where large quantities of inferior scrap or hard irons have to be melted in the foundry.

Even sulphur—the element all makers of pig iron endeavor to avoid—say from 0.1 to 0.15 per cent, is now considered essential in cylinder castings. ings. Although for a long time the actual amount of graphitic carbon in castings was not considered worthy of consideration, it is now recognized that both the amount and character of the graphite has a direct bearing on the mechanical properties of the finished castings. Professor Turner and others have drawn attention to these facts. As an instance of the embrittling effect of large graphitic plates or flakes, it is only necessary to refer to the fact that a No. 1 hematite casting with 3 per cent silicon, 3 per cent graphitic carbon, and 0.5 per cent combined carbon has a tenacity of only 22,000 pounds per square inch. Metal of a similar composition without the graphitic carbon has a tenacity after forging of about 132,000 pounds per square inch. When sulphur pyrites are melted in the cupola with open iron so as to give 0.15 per cent of sulphur in the mixture, a closer-grained iron containing the graphitic carbon in fine plates may be obtained, which is stronger in consequence.

One great advance during the last 25 years was the production of castings by melting mixtures of steel scrap and blast-furnace metal in the cupola, for they were much superior in toughness and strength to those made from furnace metal alone.

The property of high percentages of silicon in cast iron, in enabling it to resist corrosion by acids, has led to the extensive use of evaporating pans and other vessels in chemical works made from cast iron alloys containing 10 per cent or more of silicon.

To the science of the foundry a large number of well-known authorities both in America and Europe have contributed important information.

From the presidential address of Dr. John E. Stead who recently was elected president of the Iron and Steel institute at its annual meeting in London, England. Dr. Stead is one of the leading consultants and iron and steel metallurgists of Europe.

Moves Plant to Baltimore

The manufacturing plant and offices of the George Oldham & Son Co., makers of rammers, cleaning and shipping hammers, soon will be removed from Frankford, Philadelphia, to Scott & McHenry streets, Baltimore, Md. The Baltimore plant will be equipped for the manufacture of pneumatic tools.

How and Why in Brass Founding

By Charles Vickers

Making Cores for Small Brass Castings

We are experiencing difficulty in making small brass castings and bushings. The molten metal burns in through the cores and destroys the casting. Kindly advise us in regard to a suitable core composition to avoid this difficulty.

It would appear that the cores are too porous. Possibly the sand is too coarse, or the cores are made too soft. Without specific information in regard to the sand mixture used for the cores, and the composition of the metal poured around them, considerable guesswork is necessary to formulate an answer. A strong core mixture is suggested as follows: Sharp sand, 30 pounds; new molding sand 10 pounds; powdered rosin, 2 pounds. Have the sands dry when weighed. Mix the sands and the rosin, temper with water to the consistency of molding sand. The strength of the cores while green can be varied by increasing or decreasing the molding sand. A weaker core will result if floor sweepings are used in place of the new molding sand. The more sharp sand the weaker the green core will be, but it will vent more easily. The cores should be dried at a temperature that will melt the rosin, when the cores will smoke. After cooling this will prove a strong core. If a softer core is desired, decrease the amount of rosin.

Larger Risers Needed on Defective Castings

We have lately had considerable difficulty in making bronze castings of an alloy composed of copper, 78.75 per cent; tin, 8.25 per cent, and lead, 13.00 per cent. The castings weigh about 170 pounds each. They are poured at a temperature of around 1800 degrees Fahr., but fail to come sound, containing porous places and shrink holes. Any suggestions you may offer that may assist us in preventing this trouble will be greatly appreciated.

In our judgment the castings are not porous in the accepted sense of this term, that is, the difficulty is not due to gaseous metal. The fact they come porous in places and have shrink holes would indicate the entire difficulty to be one of molding. The risers are too small to feed the shrinkage of the castings, consequently the metal in the upper parts of the castings drains away to the lower parts leaving holes in the upper part, and these holes will be found at the root of the risers.

The remedy is a simple one; merely increase the diameter and the height of the risers until the trouble ceases. The question of cutting off the risers is a secondary one. Means must be found for doing this. We suggest a visit to a steel foundry and inspection of the risers necessary to get sound steel castings; also of the methods of removing these risers. While bronze can be made with smaller risers than steel, all too frequently a penurious policy is adopted in the brass foundry with the idea of saving molten metal. However, it is a direct loss if several castings have to be made to get one good one. Therefore, we advise the use of risers of generous size to properly feed the castings.

Casting Copper May Be Used

We specialize in making bronze memorial tablets and all classes of bronze ornamental work, using the following alloy: Copper, 88 per cent; tin, 5 per cent; zinc, 5 per cent; lead, 2 per cent. We would like to get your opinion in regard to whether it is best to use lake or casting copper. We use a bronze ingot of the same formula as given, and purchase this ingot from the refiners.

The difference between casting copper and lake or electrolytic copper is one of purity. The more nearly pure the copper is the higher will be its electrical conductivity, and as electrolytic copper has the highest conductivity, it follows this grade is the purest copper. For all purposes for which copper is used the purer it is the better, therefore, electrolytic is the best copper that can be obtained for making bronze ornamental work, as for everything else. It need not be decided from this statement that casting copper cannot be used for making bronze, as it can, and the bronze may be just as good as if electrolytic copper had been used. Again it may not be, a chance must be taken when using casting copper. It depends where the casting copper came from, and just what impurity it may contain. If it contains a little zinc, tin, or lead it would be satisfactory, but if it contains silicon or aluminum, even in minute quantity, it might make a poor grade of bronze. If a substantial saving can be effected by using casting copper, it is worth investigation, and a small shipment should be tried. If this proves satisfactory all is well, but provision should be made in advance to return the metal when a shipment is received which fails to give good results.

Baking Weak Cores

We are making small irregularly shaped castings having small holes cored in them, and have difficulty due to their contour which makes it impossible to place them on a plate. We dry the cores in the half core box which is of brass, and the core when dry adheres to the core box, and is broken by removal. We have oiled the box with lubricating oil, but the difficulty still persists. We would like to learn what binder we can use to better advantage than oil in this case?

For small, weak cores, oil is the best binder. Should there be large quantities of the castings to make, it will be necessary to have dryers of cast iron to support the core. These dryers are similar in shape to the half corebox and fit over the pins in the other half of the box. When the core is rammed the half box with holes is removed, the dryer takes its place, then the box is overturned and the other half is removed leaving the core in the dryer. The cores will not stick to these dryers, especially if they are warmed before being used. If there is only a small order to turn out, make a small wooden frame high enough to clear the core when it is placed over the same as it lies in the half core box; sieve molding sand over the core until the frame is filled covering the core, then fit a core plate on the sand filled frame like placing a bottom board on the drag of a mold, then invert the corebox with core, frame, sand and plate and lift off the corebox leaving the core on the plate embedded in soft molding sand which will hold it together until it is dried. When dry remove the core, and lightly brush away the dry molding sand. All oil-bonded cores require venting.

THE FOUNDRY

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Contents

	Page
All Ready For Columbus Convention	709
Who and What to See at the Big Show	717
Build Plant Where Roads Converge	725
Resume Operations in Indiana Foundry	732
Withdraws from Castings Company	732
West Point Foundry Elects Officers	732
Forehearths Not Often Installed	732
Establish Alloy Foundry	732
Selling Agency Secured	732
English Foundry Makes Rail Chairs	733
British Foundrymen Meet Above Border	740
Akron Plant Started	740
Judging Sands for Foundry Use—I	741
Buys Respirator Patents	746
Bill Takes the Bate of the Promoter	747
Coal Facing Difficult to Secure	749
Scientific Methods Needed in Foundries	750
Moves Plant to Baltimore	750
How and Why in Brass Founding	751
Making Cores for Small Brass Castings	751
Larger Risers Needed on Defective Castings	751
Casting Copper May Be Used	751
Baking Weak Cores	751
Interest Centers on Columbus	752
Foundry Iron Production Forges Ahead	752
Trade Outlook in the Foundry Industry	753
Comings and Goings of Countrymen	754
Obituary	755
Book Review	755
Foundrymen's Association Seeks Members	755
What the Foundries Are Doing	755
New Trade Publications	756

Interest Centers on Columbus

EACH successive year since its inception has marked a long step forward in the work accomplished by the American Foundrymen's association. Last year at Philadelphia, the cradle of this great technical society, unprecedented attendance, an excellent program of papers and the largest assemblage of foundry equipment and materials ever brought together set a high mark which some stated would never again be attained. Although the Columbus convention still is several weeks away, it is thought by those whose judgment is based upon 20 or 25 years observation of the association's attainments, that this year will mark a gathering which will fully equal if not surpass that at Philadelphia. Technical papers, presenting the results of profound study and achievement in the varied lines of foundry activity, will be read by authorities in the subjects of greatest moment to the present day foundryman. More than 60 of these will be read and discussed at the gray iron, steel, malleable and nonferrous sessions of the association and at the meetings of Institute of Metals division of the American Institute of Mining and Metallurgical Engineers which latter will be held simultaneously.

Foundry supply and equipment manufacturers, who are ever quick to appreciate the opportunity this annual gathering offers them in the demonstration of their products, have engaged more space and will be represented in greater numbers than ever before. Seven large buildings at the Ohio State Fair grounds will be filled with exhibits which will show the most modern developments in the casting industry.

Foundry Iron Production Forges Ahead

AN INCREASE of 43 per cent in the production of malleable pig iron during the first half of this year over the same period last year is the feature of the official statistics of pig iron production recently issued. In the first six months of 1919 the production of malleable pig iron was 465,823 tons against 666,165 tons produced the first half of 1920. This is the largest increase in tonnage shown by any grade of pig iron for the period. The increase for all grades was 13.3 per cent; 16,278,175 tons in the first half of 1919 comparing with 18,435,602 tons in the same period of 1920. The production of foundry pig iron showed a gain of 22.3 per cent covering the same periods.

These higher relative gains for foundry and malleable pig iron would indicate that the foundries of the country were even more prosperous during this period than were the steel mills, although the latter enjoyed a marked prosperity. The increase in the output of malleable may not all be attributed to demand from malleable iron foundries as many shops making gray-iron castings of thin sections requiring a dense metal use malleable pig in their mixtures, notably those plants molding automobile cylinders. However, the melt for malleable castings has evidently increased as the capacity of malleable foundries has been augmented during the past 18 months by from 25 to 33 per cent according to an authoritative report. The demand for malleable castings has increased greatly and even with the added capacity prompt deliveries of castings are still difficult to procure. Some slack which has appeared in the demand for malleable castings for the automobile trade is at present being more than taken up by the demands of the railroads.

Trade Outlook in the Foundry Industry

GREATER stability is apparent in all branches of industry with the entry of September. Improved shipping probably is the greatest single contributing factor to the return of confidence. With the feeling that better supplies of raw materials may be available and that they may be able to maintain shipments of finished products, manufacturers in general are more hopeful of the future. It still is realized that the railroad facilities of the country are entirely inadequate to handle well a peak load such as marked the past year, but improvements in operation have brought a temporary relief which it is hoped may continue until new equipment can be put in service.

Aids Coke Situation

Better rail conditions have reacted favorable to the advantage of foundries. Coke, which has been the chief cause for concern has been more readily available through better shipments from the mines and from the ovens. A slight recession in price has resulted, and it is probable that with continued improvement in the car supply, easier prices will obtain during the present month. An increase of 1 per cent in coke production in the Connellsville region was noted during the week ending Aug. 21 and the following week showed still greater shipments. The week of Sept. 1 registered a decrease in production, but continued improvement in railway conditions is shown by the shipment of a considerable tonnage of coke which had been stockpiled during the most stringent car shortage. Coke still is scarce in Alabama and all that can be produced is shipped and consumed in the territory about Birmingham. Delayed delivery on contract coke has served to keep the spot market tight, as all supplies which have been available have been shipped to meet the demand. The advance in freight rates has made little impression on coke prices, as better shipment has overbalanced the effect of this added cost.

Prices of Raw Materials for Foundry Use

CORRECTED TO SEPT. 7

Iron		Scrap	
No. 2 foundry, valley	$48.00 to 50.00	Heavy melting steel, Valley	$27.50 to 27.75
No. 2 Southern, Birmingham	42.00 to 45.00	Heavy melting steel, Pittsburgh	29.00 to 29.50
No. 2 Foundry, Chicago	46.00 to 47.00	Heavy melting steel, Chicago	26.00 to 26.50
No. 2 Foundry, Philadelphia	51.25 to 53.50	Stove plate, Chicago	32.00 to 32.50
Basic, Valley	48.50	No. 1 cast, Chicago	40.50 to 41.00
Malleable, Chicago	46.50	No. 1 cast, Philadelphia	39.00 to 41.00
Malleable, Buffalo	51.25	No. 1 cast, Birmingham	33.00 to 35.00
		Car wheels, iron, Pittsburgh	47.50 to 48.50
Coke		Car wheels, iron, Chicago	39.00 to 39.50
Connellsville foundry coke	$18.00 to 18.25	Railroad malleable, Chicago	33.00 to 33.50
Wise county foundry coke	18.50 to 20.00	Agricultural malleable, Chicago	33.00 to 33.50

Insist on Quality

With the return of more nearly normal conditions of supply, foundrymen are beginning to scan quality more closely. It has been notoriously evident for the past several months that the coke shipped to foundries has been far below standard. Urgent need has prompted many to accept this inferior coke, and 72-hour foundry coke has meant anything which the ovens have had available at the times when cars were to be had. Foundries have been obliged, under pressure of urgent necessity, to accept fuel which was taken from the ovens at the expiration of 48 hours or even less. This inferior fuel has been utilized, but with attendant cupola and casting troubles. Some of the larger by-product coke plants have maintained a better quality, and these have been able to command a premium price during the past two months. One case of a Pennsylvania foundryman is cited where $20 a ton and a $4.60 freight rate was paid for high quality coke when an inferior grade might have been obtained at $17 a ton and with less than $1 freight added.

Reaction at Hand

This growing insistence upon better quality is noted both in raw materials and finished products. Just as the foundryman is beginning to look closer upon furnace analyses of iron and quality of coke, so the consumer is becoming more exacting in his requirements. Automobile manufacturers, confronted by a reduction in scheduled production, took this means of retarding the flow of castings which was entering their plants. Those which two months ago were scouring the country seeking foundries which could supply them even 10 or 12 more cylinder castings per day found themselves suddenly obliged to curtail. To stop the oversupply of castings, many developed a keen system of inspection, which, while it may have been justified in some cases, threw a heavy burden upon the foundries. This meticulous inspection and rejection of castings has been accompanied in many instances by requests for deferred deliveries of castings contracted, and in some instances by actual cancellations of contracts extending through until next spring. Automobile shops, in general are optimistic and regard this slump in the production of passenger cars and trucks merely as a temporary condition which will be followed by an even greater demand. For this reason, few if any who find themselves with idle shop capacity are soliciting work of any other character. With few exceptions automobile shops alone have been adversely affected by recent reactions in many lines. Malleable foundries, particularly those engaged in railway and agricultural implement work have all the business that they can handle. Most jobbing shops, particularly those handling light work have sufficient business on their books to engage their capacity until the first of the year, and although there is little new work originating at this time, they are confident that a better outlook, following the fall campaign, will assure a continuance of their present prosperity. Stove and furnace establishments report undiminished demand. Cast-iron pipe is not so active, due to the inability of municipalities to dispose of bonds to finance badly needed extensions to water and gas mains. It is felt that with the return of better credit conditions, much of this demand which has been held back will materialize. Prices of nonferrous metals based on New York quotations of Sept. 7 follow: Copper, 17.87½c to 18.00c; lead, 8.25c to 8.50c; Straits tin, 45.00c; antimony, 7.12c to 7.25c; aluminum, No. 12 alloy, producers' price, 34.00c and open market, 31.50c. Zinc is quoted at 7.90c East St. Louis.

Comings and Goings of Foundrymen

JAMES T. LEE recently has resigned his position as vice president in charge of sales of the Hanna Engineering Works, Chicago, to join the sales engineering staff of the Southwark Foundry & Machine Co., Philadelphia. It is the purpose of the Southwark company to broaden its field of activity by adding to its present production of hydraulic and power machinery, a full line of pneumatic and hydropneumatic riveters and foundry molding machines. Mr. Lee received

JAMES G. LEE

his education in the manual training schools of Philadelphia and in the engineering department of the University of Pennsylvania. He has been closely associated with the foundry trade for the past 15 years. From 1906 to 1911 he was treasurer of the Rathbone Molding Machine Co., and subsequently has been western sales manager for the Mumford Molding Machine Co. and the Q. M. S. Co. He has been an active member of the Chicago Foundrymen's club, the American Foundrymen's association and a director of the Foundry Equipment Manufacturers' association.

P. H. Donavan has been made general manager of the National Brake & Electric Co., Milwaukee.

H. I. Landis, Lansdale, Pa., has sold his interest in the Lansdale Foundry Co. to J. F. High, who has assumed the active management of the company.

R. J. Wells has been promoted to the position of general foreman of the Portsmouth Metal & Foundry Co., Portsmouth, Va.

William Grede has purchased the Liberty Foundry Co., Milwaukee. Mr. Grede for some time has been associated with the Wagner Castings Co., Decatur, Ill.

B. H. Hartsfield, vice president of the Birmingham Stove Works, Birmingham, Ala., has been elected president of the Birmingham Civic association.

O. M. Swartz, who has been burgess of the borough in which he resides, has been promoted to the position of foreman of the Wincroft Stove Works, Middletown, Pa.

Julius Janes, formerly president of the Standard Steel Castings Co., Cleveland, now is sales representative in Cleveland and Cuyahoga county of the Farrel-Cheek Steel Foundry Co., Sandusky, O.

John S. Williams has resigned his position with the Gould Coupler Co., Chicago, to accept that of general superintendent of the Superior Steel Castings Co., Benton Harbor, Mich. Mr. Williams' new position became effective Sept. 1.

Frank M. Welsh, who for a number of years was in the employ of the Republic Iron & Steel Co., and later with Hickman, Williams & Co., New York, and Knapp & Baxter, New York, has been made district sales manager, with offices in New York City for the Iron Trade Products Co., Pittsburgh.

Dr. W. D. Bancroft, professor of physical chemistry at Cornell university, Ithaca, N. Y., has been engaged in consulting capacity in connection with the research laboratories of the Norton Co., Worcester, Mass. He expects to spend as much time at the Worcester and Niagara Falls plants each month as he can spare from his college work.

Robert M. Gates has been appointed managing engineer in charge of the Philadelphia district of the Lakewood Engineering Co., Cleveland. Mr. Gates who is a graduate of Purdue university is chairman of the Material Handling section of the American Society of Mechanical Engineers. For the past 12 years he has been actively associated with developments of mechanical means for conserving labor in construction, industrial and transportation lines.

E. F. Ball, Newark Stamping & Foundry Co., Newark, O., recently was elected president of the National Association of Pattern Manufacturers at the annual convention held in Toledo, O. Other officers of the association follow: Vaughan Reid, City Pattern Works, Detroit, and J. V. Brost, Brost Pattern Works, Cleveland, vice presidents; E. O. Melvin, Melvin Bros., Pattern Works, Columbus, O., secretary and treasurer. A. E. Schuchert, A. E. Schuchert Pattern Works, Cincinnati; J. H. Bridge, Maumee Pattern Co., Toledo, O., and William Neilson, Boston, were elected trustees.

FRED J. BRUNNER

Fred J. Brunner, one of the best known foundry supply men in the business, recently has become affiliated with the Hill & Griffith Co., Cincinnati, in the capacity of secretary and sales manager. In 1893 he started with the J. D. Smith Foundry Supply Co., which was located in Cincinnati at that time. After severing his connection with the J. D. Smith Co., he was associated with the S. Obermayer Co., Chicago, for 16 years as assistant manager at the general office in Cincinnati. Since its origin seven years ago Mr. Brunner has been connected with the Hill-Brunner Foundry Supply Co.

Obituary

William E. Sessions, president of the Sessions Foundry Co., Bristol, Conn., and for many years at the head of several of the largest business enterprises in that city, died suddenly on the morning of August 27 at his home on Bellevue street. Mr. Sessions was born in Bristol, Feb. 18, 1857 and spent all his life there. His school days in Bristol and high school days in Hartford being followed by intimate association with the enterprises founded by his father the late John Humphrey Sessions.

After a year or two in the office of J. H. Sessions & Son, he entered in 1879 into the management of the foundry which his father had just bought, and which later became one of the largest in the state. Beginning with a force of about a dozen men the business steadily grew until it became one of the large industries in the city.

At the time of his death Mr. Sessions was president of the Sessions Foundry Co., president of the Sessions Clock Co., and also of the Bristol Trust Co. He was one of the organizers of the latter company and had been president since its formation. He was a director in all three, a trustee of Wesleyan university and a member of the executive committee. He was a member of the first board of burgesses of Bristol and in 1908 was a republican presidential elector, voting for William H. Taft.

Mr. Sessions married Emily D. Brown of Ellington, June 12, 1878. Besides his widow he is survived by two sons, Joseph B. Sessions, treasurer of the Sessions Foundry Co. and William Kenneth Sessions, vice president of the same company.

H. I. Wassenstrom, president of the Acme Brass Foundry Co., 4042 Liberty avenue, Pittsburgh, died at St. Margaret's hospital, in that city, on July 21. Mr. Wasserstrom formerly lived in Cleveland.

Book Review

The Strategy of Minerals, edited by George Otis Smith, director of the United States geological survey; 5 x 8 inches, 360 pages; published by D. Appleton & Co.; furnished by THE FOUNDRY for $2.50.

This book sets forth the essential part that minerals played in the Great War, it records our wartime experiences and discusses the part that mineral raw materials now have in the reconstruction of the world. It opens with a discussion on the relation of geographical position and economic resources in their relation to international commerce with particular reference to mineral raw materials. It then goes on to describe the disturbance of the mineral industry of the United States through war conditions and deals exhaustively with the shipping crisis. Each main group of mineral raw materials is treated by a recognized authority, the survey covering the war demands, the problems and means of increased production, technical progress, new sources of material, reserve supplies, etc. A chapter of special interest deals with present tendencies of power production to further the conservation of mineral fuels and another chapter traces the history and activities of the fuel administration during the war. The concluding chapters deal with the future place of the United States in the world market and its obligations as custodian of the world's greatest repository of mineral raw materials. A comprehensive index at the back furnishes a means of quickly finding subjects.

Foundrymen's Association Seeks Members

The American Foundrymen's association has designated Sept. 20-25 as a special "Foundrymen's Week" during which time concerted effort will be made to reach all nonmember foundrymen with a personal invitation to join. The committee on promotion and membership is enlisting the co-operation of members in all parts of the country and team captains are being appointed for each city or group of towns. Application for membership before or during "foundrymen's week" will be acted upon by the American Foundrymen's Association board of directors in time to qualify the applicants with full membership privileges for the annual convention in Columbus, week of Oct. 4.

What the Foundries Are Doing

Activities of the Iron Steel and Brass Shops

The Springfield Malleable Iron Co., Springfield, O., is erecting an additon to ts plant.

The Rogers Foundry Co., Joplin, Mo., has openeo a malleable iron foundry at Baxter Springs, Kans.

The Allerton Foundry Co., Niles, Mich., recently was incorporated with a capital stock of $50,000.

The Unit Stove Co., Birmingham, Ala., plans to enlarge its plant.

The plant of the Stieger & Kerr Stove & Foundry Co., 2201 Folsom street, San Francisco, recently was damaged by fire.

The Kenton Hardware Co., Kenton, O., has strated work on the erection of an addition to its foundry, 60 x190 feet.

The National Alloys Co., Woodbridge street, Detroit, is having plans prepared for the erection of a foundry 60 x 100 feet.

The New Idea Spreader Co., Coldwater, O. has awarded a contract for the erection of a foundry, 117 x 157 feet.

The Bucyrus Copper Kettle Works, Bucyrus, O., manufacturer of copper, brass and other metal products, has awarded a contract for the erection of a new plant building, 60 x 235 feet.

The M. D. Jones Foundry Co., Concord, Mass., which recently completed the erection of a plant, 58 x 90 feet, will start operations soon.

The Kilburn-Lincoln Machine Co., Fall River, Mass., has let a contract for the erection of an addition to its foundry to be 40 x 45 feet.

The Reading Valve & Fittings Co., Reading, Pa., has had plans prepared for the erection of an addition to its plant.

The Salem Foundry & Machine Corp., Roanoke, Va., is reported planning the erection of a foundry and machine shop.

The Joplin Foundry Co., Joplin, Mo., has started construction of a new office and warehouse building at its plant. It will be 50 x 50 feet.

The capital stock of the Kilby Pipe & Foundry Co., Birmingham, Ala., recently was increased from $30,000 to $100,000.

The James J. Lacey Co., Block and Wills street, Baltimore, is reported planning the erection of an addition to its plant, 52 x 70 feet. The company manufactures iron and steel castings.

The Sharp Foundry & Supply Co., New Philadelphia, O., is making some improvements at its plant.

The Woodhill Brass Co., Cleveland, recently was incorporated with a capital stock of $100,000, by J. P. Ferencik, F. R. Noss and others.

The West Point Foundry Co., West Point, Pa., has been incorporated with a capital stock of $30,000, by S. B. Strauss, Herbert L. James and others.

The Sandusky Foundry & Machine Co., Sandusky, O., has acquired property adjoining its plant including a building, which will be remodeled for use as a pattern shop.

The Chicago Nipple Mfg. Co., 910 West Lake street, Chicago, manufacturer of valves, fittings, etc., is reported to be considering improvements to its plant.

The Eastern Foundry Co., 152 Main street, South Rye, N. J., manufacturer of iron and steel cast-

ings, etc., has increased its capital stock from $350,000 to $1,000,000.

The East Penn Foundry Co., Macungie, Pa., has started preliminary work in its new foundry. Additonal equipment will be installed.

The Lewiston Foundry & Machine Co., Lewiston Pa., is devoting operations almost exclusively to the manufacture of sand pulverizing machinery and parts.

The Burnside Steel Co., 1300 East Ninty-second street, Chicago, has awarded a contract for the erection of a 1-story core room, office and pattern shop, 40 x 100 feet.

The American Woodworking Machinery Co., 591 Lyell avenue, has awarded a contract for the erection of a machine shop, 2-stories, 90 x 300 feet, and a foundry 110 x 130 feet.

Capitalized at $25,000, the Kaufer Mfg. Co., New York, recently was incorporated to engage in the manufacture of stoves, etc., by A. R. Locke, M. and T. Kaufer, 500 Southern boulevard.

The Oldsmar Tractor Co., Oldsmar, Fla., plans to erect a machine shop and foundry and will enlarge ts output. The company recently increased its capital. H. L. Keller is general manager.

The National Woodworking Machinery Co., Dover, N. H., has awarded a contract for the erection of a machine shop, 35 x 100 feet, a foundry, 50 x 100 feet and a pattern shop, 40 x 100 feet.

The Omega Valve Co., Atlantic City, N. J., has been incorporated with a capital stock of $100,000, to manufacture plumbing fixtures, etc., by S. A. Burris, W. Barrett and Charles Park.

The foundry formerly occupied by the Northampton Iron Works, West street, Florence, Mass., has been turned over to Ernest Moeckel, who has been in charge of the Easthampton Foundry, Easthampton, Mass.

The American de Levaud Mfg. Co., Ltd., Toronto, Ont., has been incorporated with a capital stock of $7,500,000, to manufacture cast iron, brass, etc., by F. A. Blackburn, 93 Lonsdale road, Toronto, John H. Phippen and Hugh J. Dawson.

The J. H. Charles Co., Ltd., Dunnville, Ont., has been incorporated with a capital stock of $40,000, by J. H. Charles, 227 Evelyn avenue, Dunnille, Albert Frances and George H. Orme, to manufacture castings, etc.

The Watson-Stillman Co., 190 Fulton street, New York, manufacturer of pumping machinery, brass and other metal castings, etc., has awarded a contruct for the erection of an addition to its plant at Aldine, N. J.

The Johnson Bronze Co., South Mill street, New Castle, Pa., has awarded a contract for the erection of a machine shop, 2-stories, 32 x 62 feet, a core building, 52 x 68 feet, and a foundry, 65 x 160 feet.

The Colonial Foundry Co., Lousville, O., has increased its capital stock from $65,000 to $250,000, and will make improvements and extensions to its plant with a view to making heavier castings. A 10-ton crane will be installed.

The capital stock of Foster, Merriam & Co., Merriam, Conn., manufacturer of brackets, castings, etc., will be increased to $1,000,000 to take care of improvements and increasing business. R. W. Millard is president of the company.

The Ashland Malleable Co., Ashland, O., recently organized with a capital stock of $150,000, has acquired a 4-acre site on which t will build a malleable iron foundry, 100 x 200 feet. J. H. Firestone is president.

Lewis R. Palmer and George C. Palmer of Ridley Park, Pa., were named among the incorporators of the Mt. Holly Foundry Co., which recently was incorporated in Delaware with a capital stock of $100,000.

The Rice Valve & Foundry Co., Indianapolis, has ben incoporated with a capital stock of $20,000, and will engage in the manufacture of valves, etc. The incorporators are Reece Rice, Albert Wenner and Carl R. Reynolds.

The pattern shop and storeroom of the Canada Iron Foundries, Ltd., St. Thomas, Ont., and the casting foundry, material sheds and shipping room of the Dominion Brake Shoe Co. recently were damaged by fire.

S. D. Lane, Alliance, O., is said to have sold his plant at Alliance, known as the Mann Car Indicator Co., to interests which are organizing a foundry company. Repairs are under way and it is expected to plant will be in operation by Nov. 1.

The Huntington Steel Foundry Co., Huntington, Ind., has been reorganized and refinanced. The new stockholders include, W. H. Armstrong, Racine, Wis., Edward T. Pelton, N. I. Silver and Leo Cohan Gray iron work will be abondoned and steel castings will be made exclusively.

D. Round & Son, Cleveland, manufacturer of chain and chan hoists, will erect a foundry adjoining its plant which will be 100 x 150 feet, and equipped for the present with one cupola. This plant will be used for the manufacture of gray iron castings.

Work has started on the addition to the molding floor of the Mansfield Foundry Co., Mansfield, Mass. The addition is to be 90 x 120 feet and will be served by an additional 10-ton crane, contract for which has not yet been awarded. E. J. Morrow, manager, states the addition probably will be ready for operation by Oct. 1.

To keep pace with its expanding business the Harrold Tool & Forge Co., Columbiana, O., has been granted permission to increase its captal stock from $25,000 to $50,000. The firm, which operates a foundry and metal works at Columbiana, is planning to erect an addition. New machinery will be purchased.

Erection of a new brass foundry with approximately 15,000 square feet of floor space, will be strated shortly for the Claus-Automatic Gas Cock Co., Becker and Booth streets, Milwaukee. The company is interested in all types of labor-saving foundry equipment, including tumbling, melting and metal carving devices. Walter E. Claus is an officer of the company.

The Roberts Mfg. Co., 106 South Tennessee street, Atlantic City, N. J., has an option on a factory building, and is said to be in the market for punches, lathes, milling machines and foundry equipment. The company was recently organized with a capital stock of $125,000, to manufacture well points, pumps, soil pipe and fittings. F. J. Friez is president, Levi D. Roberts, vice president and George A. Evans, secretary-treasurer.

Intending to build in the spring, the New England Smelting & Refining Co., Pleasant street, Ansonia, Conn., has rented and equipped a foundry where solder, babbitt, etc., will be manufactured. This company recently was incorporated with a capital stock of $50,000, by Nathan Britzker, D. Simons, G. Liftig, S. J. Liftig and L. Egger.

Contract for the erection of the first building 100 x 190 feet, of a plant for the Porter Tractor Co., Colfax, Iowa, has been awarded and work on the structure is now under way. The building will be utilized for offices, asembly room and machine shop. Later, other buildings will be erected including a foundry. As yet the company has not closed on its foundry, heating plant, machine shop and general factory equipment.

Negotiations are in progress for the transfer of the Cedar Grove Stove Co., Cedar Grove, Wis., to new interests represented by Peter Dittlehoff, who recently resigned as seperintendent of the foundries of the Beaver Dam Malleable Range Co., Beaver Dam, Wis. The Cedar Grove company was organized in 1901 to make stoves and malleable castings, and at present is capitalzed at $50,000. John Van de Wall is president.

To cope with the steadily increasing demand for its products, the A. E. Martin Foundry & Machine Co., 705 Park street, Milwaukee, will make its second important plant extension this year. Plans have been completed for the erection of a brick and steel gray iron foundry addition, 32 x 145 feet and a new coreroom, 100 x 100 feet. With additions recently completed, the capacity of the plant is increased to about 25 tons a day and this extension will further increase the output to 35 or 40 tons a day.

For the purpose of operating a foundry and machine shop the Bayside Foundry Co., Fall River, Mass., recently was incorporated with a capital stock of $300,000, and arrangements have been made for the taking over of the Mechanic's Foundry & Machine Co. The company also is said to be planning to establish other plant units in New England. Officers of the company are: President, Jernoe P. Fogwell; treasurer, Julius P. Sokoll, auditor and cost accountant, Rufus B. Delano and directors, Herbert Austin and Robert W. McGregor.

New Trade Publications

FORGES.—Wright Bros. Mfg. Co., Ft. Worth, Tex., is circulating a card circular in which a knockdown forge is described and illustrated. The forge is 42 inches square and 28 inches high.

FOUNDRY EQUIPMENT.—Jolters, squeezers, pouring devices, stripping machines and other foundry equipment, are described and illustrated in a 4-page folder being circulated by the Arcade Mfg. Co., Freeport, Ill.

STREET LIGHTING.—The latest developments and recommendations for street, boulevard and parkway lighting are described and illustrated in a bulletin being circulated by the General Electric Co., Schenectady, N. Y.

MOTOR TRUCK.—The Acme Motor Truck Co., Cadillac, Mich., has published an illustrated booklet in which the various points of trucks which the company manufactures, are called to the readers attention. Specifications, etc., are given.

DEFLECTION POTENTIOMETER.—The General Electric Co., Schenectady, N. Y., has issued a bulletin in which a deflection potentiometer is described and illustrated. It is designed particularly for giving accuracy between the precision potentiometer and the laboratory standard instrument.

PORTABLE ELECTRIC TOOLS.—The Independent Pneumatic Tool Co., Chicago, has published a 4-page folder in which portable electric drills, grinders, etc., are described and illustrated. One illustration shows an electric drill equipped with a new pistol grip handle, being used on a motor truck frame.

WELDING EQUIPMENT.—Oxy-acetylene welding and cutting apparatus and carbide lights, are described and illustrated in a booklet being circulated by the Alexander Milburn Co., Baltimore. In addition accessories for this equipment is also described. The illustrations show the various equipment and each is described in full.

ENAMELING.—The Porcelain Enamel & Mfg. Co., Baltimore, is circulating an illustrated booklet in which complete data on porcelain enameling plant equipment is given. The booklet is well illustrated showing various plants where this equipment is used. The front of the book contains data and descriptions of the various process of enameling as well as a short history of the art.

PUBLICATIONS.—The American Society of Mechanical Engineers, New York, has issued a list of papers and discussions published by the society. Another folder being circulated by the society calls attention to the *Engineering Index*, a book which it publishes, and which contains a record of the world's engineering progress during 1919. The book contains over 500 pages and treats on more than 5000 subjects.